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Dräger medical
A Dräger and Siemens Company

Technical Service Manual

Part Number: 4112488-001
Rev: N
Date: 16 December 2003

Vitalert 3000 Series
Vital Signs Monitoring System

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North American Dräger

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DESCRIPTION **PAGE**

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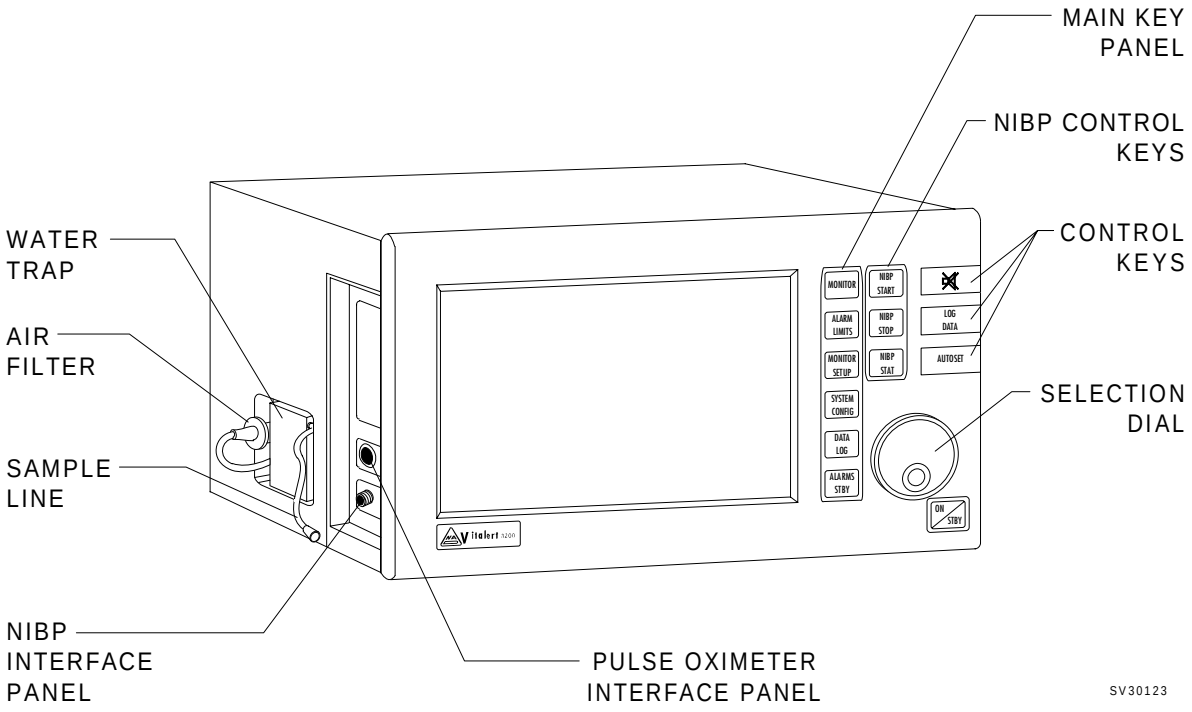
MAIN KEY PANEL
NIBP CONTROL KEYS
CONTROL KEYS
SELECTION DIAL
WATER TRAP
AIR FILTER
SAMPLE LINE
NIBP INTERFACE PANEL
PULSE OXIMETER INTERFACE PANEL
MONITOR
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MONITOR SETUP
SYSTEM CONFIG
DATA LOG
ALARMS STBY
NIBP START
NIBP STOP
NIBP STAT
LOG DATA
AUTOSET
ON STBY
SV30123

1.0 Recommendations

Because of the sophisticated nature of Draeger Medical, Inc. monitoring equipment and its critical importance in the operating room setting, it is highly recommended that only appropriately trained and experienced professionals be permitted to service and maintain this equipment. Please contact DrägerService at (800) 543-5047 for service of this equipment.

Draeger Medical, Inc. also recommends that its monitoring equipment be serviced at three-month intervals. Periodic Manufacturer's Service Agreements are available for equipment manufactured by Draeger Medical, Inc.. For further information concerning these agreements, please contact us at (800) 543-5047.

Draeger Medical, Inc. products/material in need of factory repair shall be sent to:

DrägerService
3124 Commerce Drive
Telford, PA 18969
(Include RMA Number)

HOW TO USE THIS MANUAL

The manual is divided into several sections. The DIAGNOSTICS section describes self-test and service diagnostics for checking the system functions. An understanding of the on-board service capabilities is necessary before any attempt is made to troubleshoot the unit. The TROUBLESHOOTING section provides troubleshooting guides to assist the TSR in locating the source of a problem. The REPLACEMENT PROCEDURES section contains instructions for removal and replacement of the assemblies that are considered field-replaceable. The ADJUSTMENT AND CALIBRATION PROCEDURES section contains the field procedures needed to restore original system specifications. The Periodic Manufacturer's Service (PMS) PROCEDURE section outlines the steps required to verify the electrical, mechanical and pneumatic safety of the unit and also identifies components requiring periodic replacement.

GENERAL TROUBLESHOOTING GUIDELINES

Troubleshooting the VITALERT 3000 should always begin by communicating with those who observed or experienced the problem with the unit. This may eliminate unnecessary troubleshooting steps. Once a general problem is identified, refer to the troubleshooting flow charts in Section 3 of this manual to determine proper corrective action.

After a component is replaced, verify that the unit is operating properly by running the appropriate diagnostic procedure. The PMS PROCEDURE in Section 6 must also be performed after any component has been replaced, removed, calibrated or adjusted.

The general arrangement of a VITALERT 3200 Monitor is shown on the opposite page.

WARNINGS are used in this manual before procedures which if not performed correctly could result in personal injury.

CAUTIONS are used in this manual to alert service personnel to the possibility of damage to the equipment if a procedure is not performed correctly.

EQUIPMENT CLASS: IEC 601 Class 1, Type BF, continuous

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Disclaimer

The content of this manual is furnished for informational use only and is subject to change without notice. Draeger Medical, Inc. assumes no responsibility or liability for any errors or inaccuracies that may appear in this manual.

2.0 DIAGNOSTICS

The VITALERT 3000 Series contains a diagnostic system that monitors certain system functions and records their operational status. A series of tests is performed when the instrument is powered up and the results are displayed on the diagnostics screen shown in Figure 2-1. If any of these tests fail, consult Section 3 for proper corrective action.

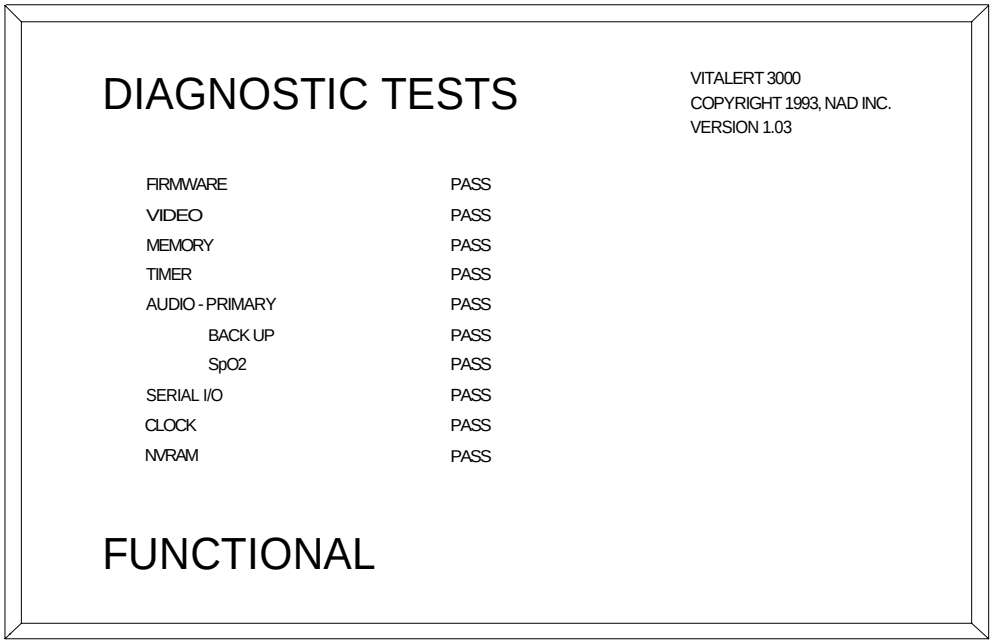
The operational status of the VITALERT 3000 Series is shown at the end of the power-up self-diagnostics and will be one of the following:

FUNCTIONAL: All self-diagnostic tests pass, and the instrument begins normal monitoring operation.

CONDITIONALLY FUNCTIONAL: A non-critical fault has been detected, and the MONITOR key must be pressed to continue operation. The instrument may continue to be used in this situation, but steps shall be taken to eliminate the problem.

NON-FUNCTIONAL: The self-diagnostic tests reveal a problem in the instrument. A summary of the diagnostic results is posted and normal operation is inhibited. The instrument cannot be operated until the problem is corrected.

Further diagnostic functions are available through service screens that can be accessed as described on the following pages. If no display is present upon system power-up, refer to Section 3 of this manual for troubleshooting assistance.



SV30101

Figure 2-1: POWER-UP DIAGNOSTICS SCREEN

2.1 Main Service Screen

The VITALERT 3000 Series monitors include a maintenance mode that allows the setting of gas sample flow rates, gas analyzer calibration, diagnostic testing of the NIBP and SpO_2 monitors. A Preventive Maintenance Schedule (PMS) screen is also provided for setting the next PMS due date. These maintenance functions are represented by a series of screens described on following pages, that can be accessed from the Main Service Screen shown in Figure 2-2. In addition to these functions, a series of Secondary Service screens allows viewing of the machine's service log and making service entries.

The Main Service Screen displays the serial number, the date that the instrument was last serviced, the hours since last service, total hours on the instrument and the version number for each software set in the instrument.

To access the Main Service Screen, simultaneously press and hold the MONITOR and SYSTEM CONFIG keys. While holding the keys, press the rotary dial.

With the rotary dial, set the cursor to the Service Person Identification box and press the dial. Scroll to the first character of your Service I.D., then enter the selection by pressing the dial. Enter the three remaining I.D. characters in the same manner.

Use the rotary dial to select the service screens described in the following paragraphs. Selecting RESET and pressing the dial will set the last service date to the current date, and the hours run since last service to zero. Pressing the MONITOR key on the front panel will return the instrument to normal operation.

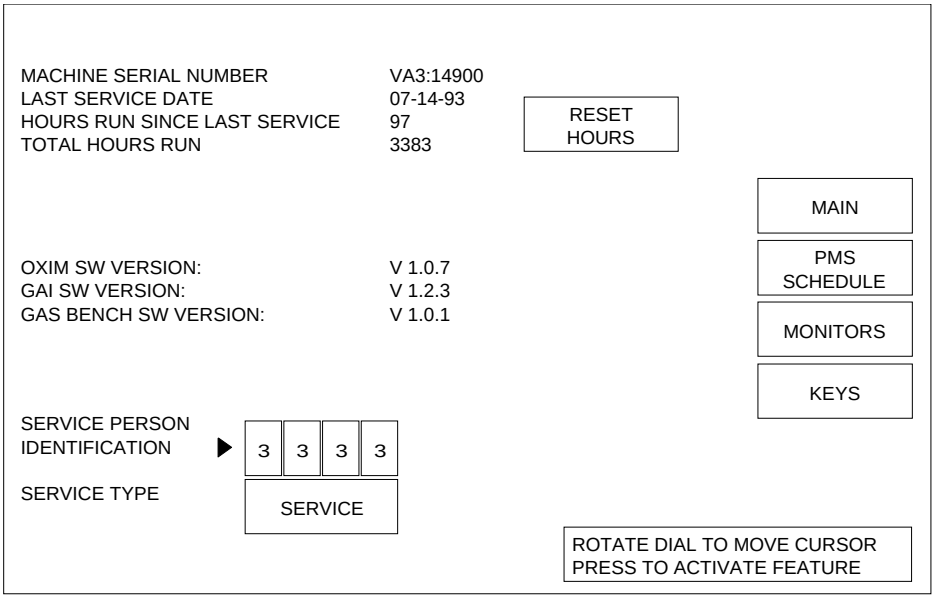


Figure 2-2: MAIN SERVICE SCREEN

2.2 PMS Schedule

To enter the PMS Screen from the Main Service Screen:

- Use the rotary dial to position the cursor at PMS SCHEDULE, and press the dial. The cursor will then move to the Month function as shown in Figure 2-3.

- Press the dial to highlight the function.

- Rotate the dial to select the desired month for the next PMS reminder, and press the dial to save the setting.

The recommended PMS interval for the Vitalert 3000 Series monitors is three months. If the current date exceeds that which has been selected and entered, a Preventive Maintenance Due message will appear on the power-up diagnostics screen.

Following the PMS month selection:

- Use the rotary dial to set the cursor on MONITORS to proceed with other maintenance screens . (Selecting MAIN will return you to the Main Service Screen.)

- Press the dial to enter the selected screen.

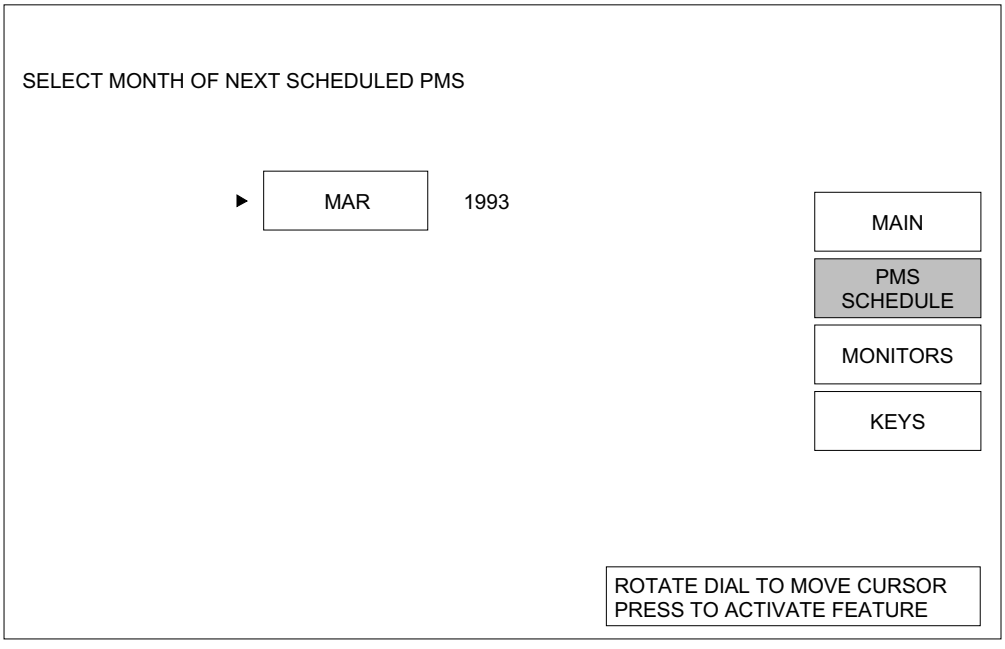


Figure 2-3: PMS SCHEDULE SCREEN

2.3 Monitors

When the cursor is set to MONITORS and the dial is pressed, a second column of selections is displayed. These are used to select specific monitors as described in the following paragraphs.

2.3.1 SpO_2 Service Screen

While still in the Main Service Screen, note the "OXIM SW VERSION" number. It should be of the form "V x.x.x" or "Vx.x.x.x". The former indicates that a Nellcor MP-202 is installed. The latter indicates a MP-203.

Set the cursor to SPO2 and press the dial. A typical SpO_2 service screen is shown in Figure 2-4.

This screen displays the current values for SpO_2 and Pulse to verify that the pulse oximeter is operational. A calibration check can be made by disconnecting the SpO_2 sensor prior to power up, and connecting a Nellcor® model PT-2500 Pocket Tester. The screen should then display an SpO_2 value of 81 ± 1, and a Pulse value of 61 ± 1 for a MP-202, 40 ± 1 for a MP-203. Connection details are illustrated in Section 5.

To enter another service screen, set the cursor to the desired selection, and press the dial. (Selecting MAIN and pressing the dial will return you to the Main Service Screen.)

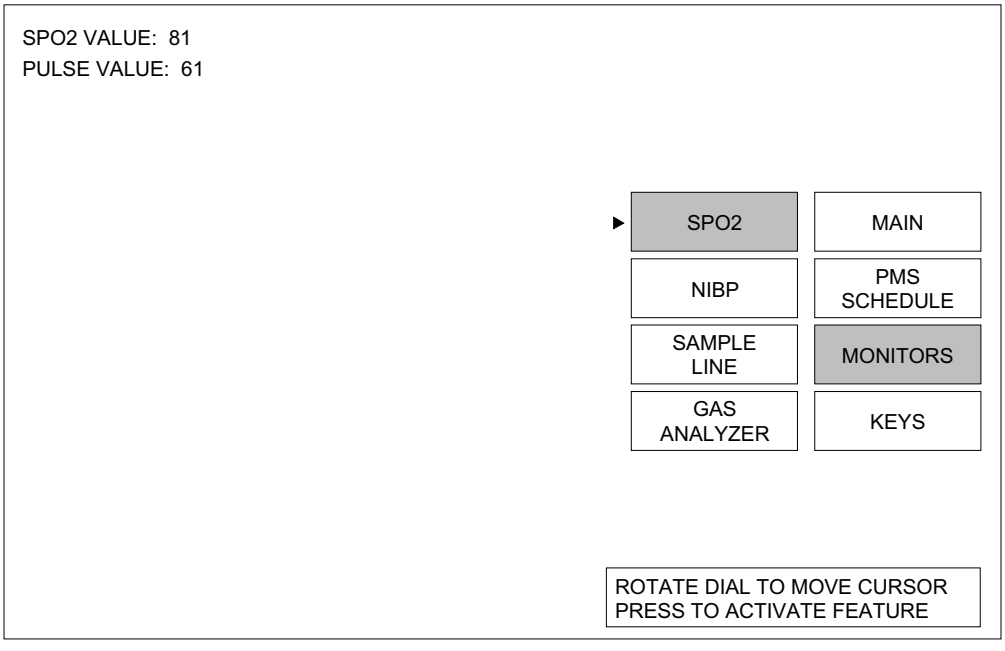


Figure 2-4: SpO_2 SERVICE SCREEN

2.3.2 NIBP Service Screen

Set the cursor to NIBP and press the dial. A typical NIBP service screen is shown in Figure 2-5.

This screen indicates the cuff inflation pressure and also provides a timing period after inflation for leak testing. On-screen instructions provide a method of checking pressure calibration with an external gauge. Connection details are illustrated in Section 5.

- Connect a BP cuff to the patient interface panel on the left side of the instrument, and wrap the cuff around a cylindrical object.
- Use the rotary dial to position the cursor at TEST, and press the dial to begin cuff inflation.
- Wait one minute, then compare the test gauge reading with the displayed CUFF PRESSURE VALUE. The readings should agree within ± 5 mm Hg.

The Cuff Pressure Value will be displayed until the cuff deflates (approximately four minutes after the start of inflation). The STATUS line will then display the result of the test.

NOTE: With software version 1.05 the sensitivity of the automatic test may be too high. If a "FAIL" message appears, perform the leak test described in Section 5 before making repairs.

To enter another service screen, set the cursor to the desired selection, and press the dial. (Selecting MAIN and pressing the dial will return you to the Main Service Screen.)

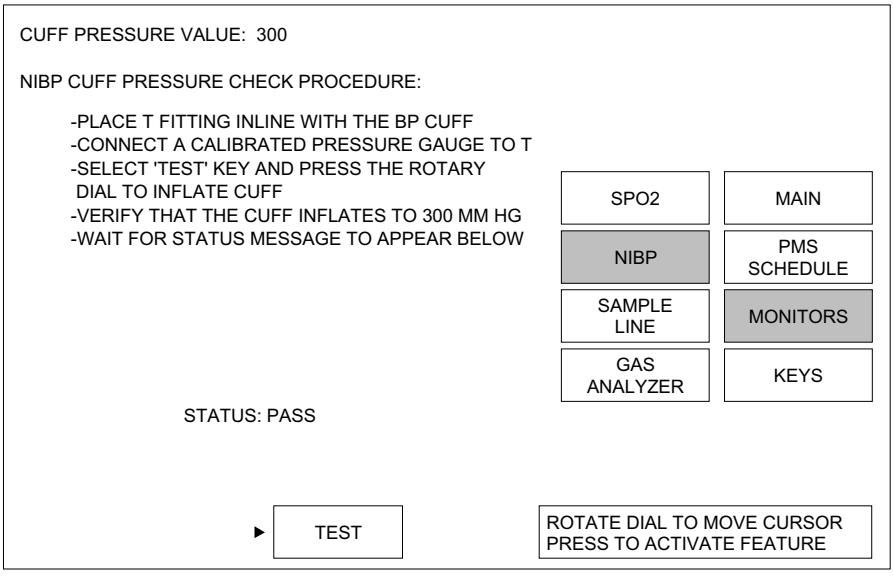


Figure 2-5: NIBP SERVICE SCREEN

2.3.3 Sample Line Flow Service Screen

Set the cursor to SAMPLE LINE and press the dial. A typical Sample Line service screen is shown in Figure 2-6.

This screen allows gas sample flow rates (100 ml/min. and 200 ml/min.) to be set using an external flow meter connected to the exhaust port on the rear panel of the instrument.

A calibration procedure for the Low Flow and High Flow is displayed on-screen. A more complete calibration procedure for the low and high flow rates is given in Section 5 along with a calibration verification and line block alarm test.

To enter another service screen, set the cursor to the desired selection, and press the dial. (Selecting MAIN and pressing the dial will return you to the Main Service Screen.)

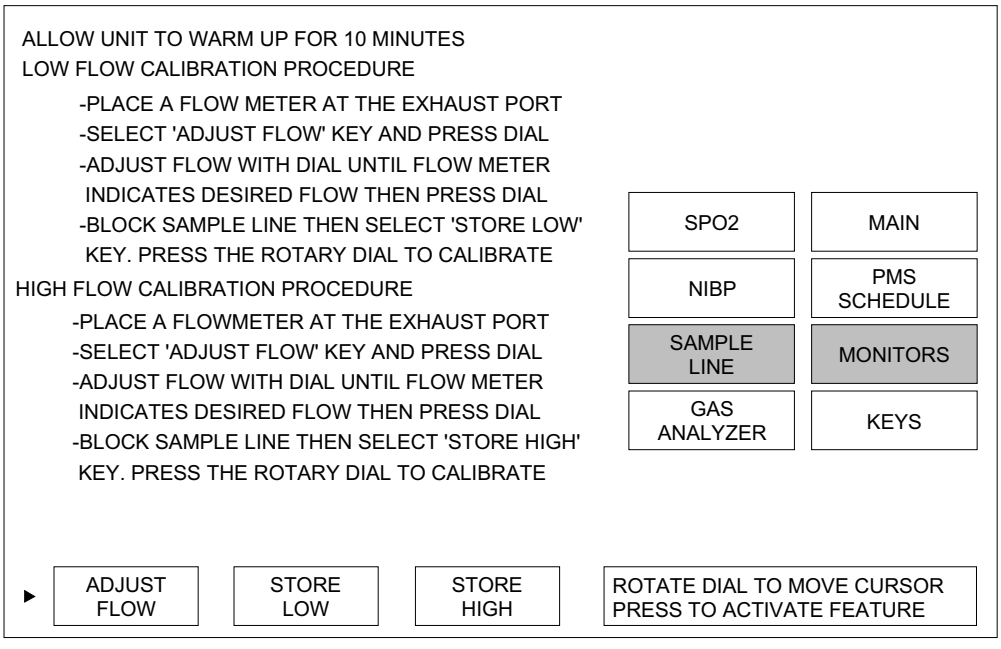


Figure 2-6: SAMPLE LINE FLOW SERVICE SCREEN

2.3.4 Gas Analyzer Service Screen

Set the cursor to GAS ANALYZER and press the dial. A typical Gas Analyzer service screen is shown in Figure 2-7.

This screen displays current values for CO_2, N_2O and anesthetic agent, along with a procedure for performing a span calibration of the gas analyzer using a certified gas sample of known accuracy.

Before performing a span calibration, an accuracy test should be performed to determine whether a span calibration is needed.

Refer to Section 5 for the complete calibration procedure, including an accuracy test, equipment required and test connections.

To enter another service screen, set the cursor to the desired selection, and press the dial. (Selecting MAIN and pressing the dial will return you to the Main Service Screen.)

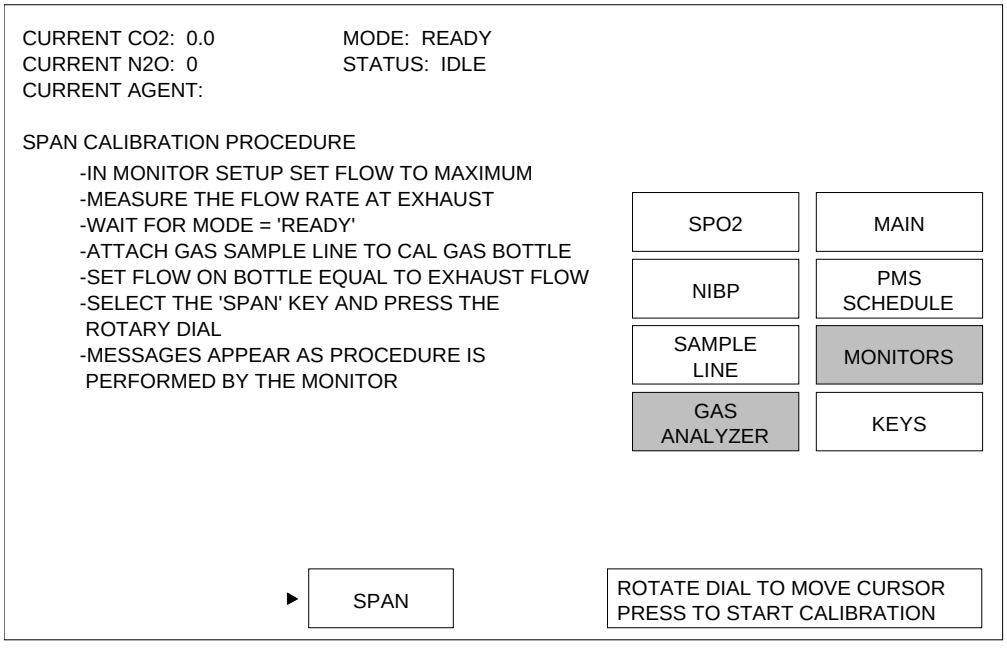


Figure 2-7: GAS ANALYZER SERVICE SCREEN

2.4 Keys

At the time of this writing, the software has not yet been implemented for producing the test pattern to verify operation of the front panel keys.

Figure 2-8: KEY TEST SCREEN

2.5 Secondary Service Screens

The secondary service screens are described on the following pages. These screens allow viewing and making entries into the service log, and include a setup screen to turn monitoring functions on or off.

To enter the Secondary Service screens from the Main Service Screen:

- A Service Person Identification must be entered as described under Paragraph 2.1.
- Using the rotary dial, set the cursor to MAIN, and press the dial to illuminate the box.
- Slowly turn the dial clockwise until a numeral 2 appears at the bottom of the screen as shown in Figure 2-9.
- Slowly turn the dial counter-clockwise until the numeral 5 appears.
- Slowly turn the dial clockwise until the numeral 6 appears.
- Press the dial to bring up the Service Log Screen (described on the next page).

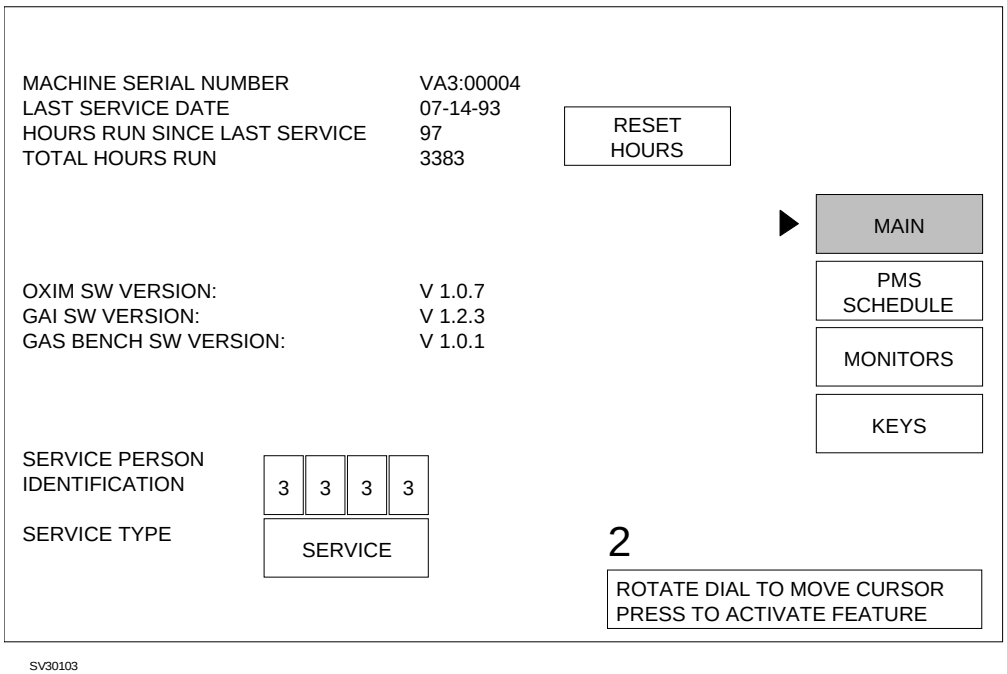


Figure 2-9: MAIN SERVICE SCREEN - SECONDARY SERVICE SCREEN ENTRY

2.5.1 Service Log Screen

Set the cursor to SERVICE LOG and press the dial to enter the Service Log Screen.

The Service Log Screen presents a chronological listing of operational and service events as shown in Figure 2-10. When this screen appears, the most recent entries are displayed.

To scroll through the complete list, set the cursor to SCROLL and press the dial. Turning the dial clockwise or counter-clockwise will allow you to scroll backward or forward through the list.

To add a service entry to the log, refer to the Codes screen described on the next page.

To enter another secondary service screen, set the cursor to the desired selection, and press the dial. (Selecting MAIN and pressing the dial will return you to the Main Service Screen.)

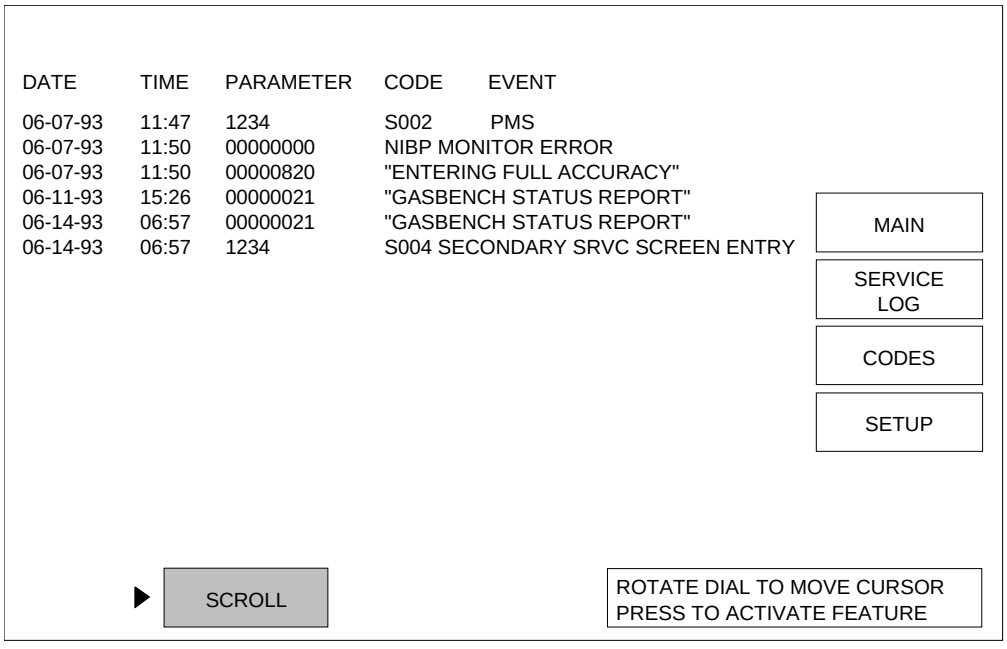


Figure 2-10: SERVICE LOG SCREEN

2.5.2 Codes Screen

Set the cursor to CODES and press the dial to enter the Codes screen.

The Codes Screen presents a list of service codes and related events that can be selected and entered into the service log. See Figure 2-11.

To place an entry into the service log:

- Turn the dial to scroll through the list, and set the cursor in front of the selected entry.
- Press the dial.
- Position the cursor at YES or NO, as desired, and press the dial. If YES is chosen, the selected entry will be placed in the service log. If NO is chosen, the selected entry will be cancelled and another selection can be made.

To enter another secondary service screen, set the cursor to the desired selection, and press the dial. (Selecting MAIN and pressing the dial will return you to the Main Service Screen.)

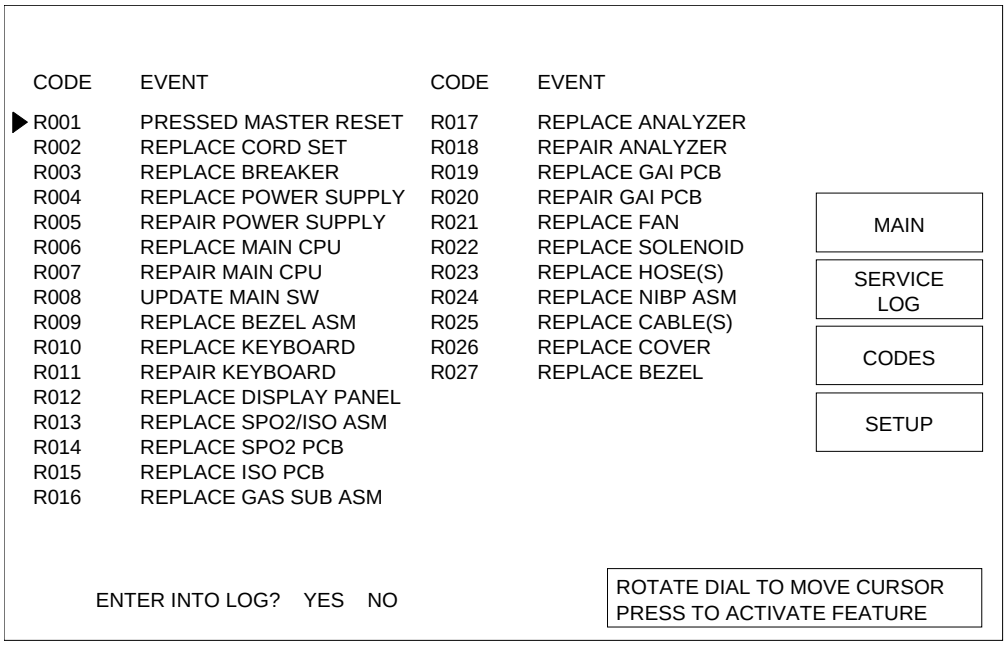


Figure 2-11: CODES SCREEN

2.5.3 Setup Screen

Set the cursor to SETUP and press the dial to enter the Setup screen.

The Setup screen, shown in Figure 2-12, provides the following functions:

- Allows entry of the machine serial number (for display on the Main Service Screen). This needs to be done when a processor board is replaced, and may also need to be done when software is updated.

- Allows monitoring functions to be turned OFF or ON.

- Allows Factory Reset to delete the calibration settings and clear the service log.

WARNING: The factory reset is to be done only by Drägerservice. All settings and calibrations must be redone following a factory reset. Important service data will be lost.

To enter another secondary service screen, set the cursor to the desired selection, and press the dial. (Selecting MAIN and pressing the dial will return you to the Main Service Screen.)

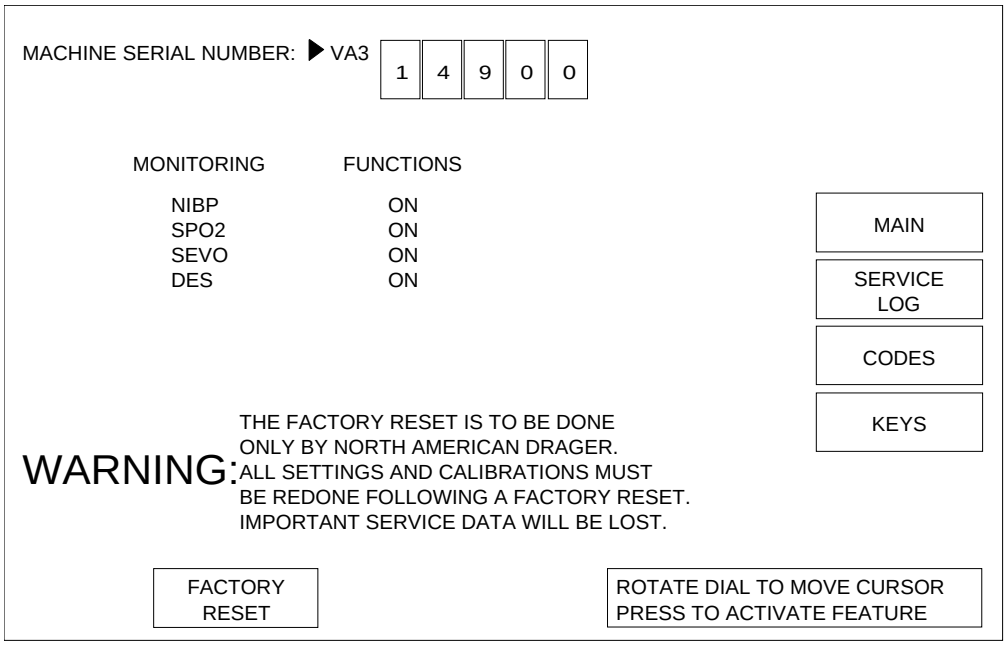


Figure 2-12: SETUP SCREEN

3.0 TROUBLESHOOTING

This section contains information to assist the Technical Service Representative (TSR) in locating electrical faults affecting the VITALERT 3000 Series monitors. Since most troubleshooting efforts begin with verifying power supply voltages, the following paragraph outlines the voltage distribution scheme within the instrument along with cable connector identification.

3.1 Power Supply and Voltage Distribution

Figure 3-1 shows a block diagram of the voltage distribution within the VITALERT 3000 from the power supply. J7 on the Gas Analyzer Interface PCB (see Figure 3-2) provides the safest, most convenient point to measure power supply voltages. The voltages are given in Table 3-1 along with their allowable tolerances. Refer to Section 4 of this manual for appropriate removal and replacement procedures.

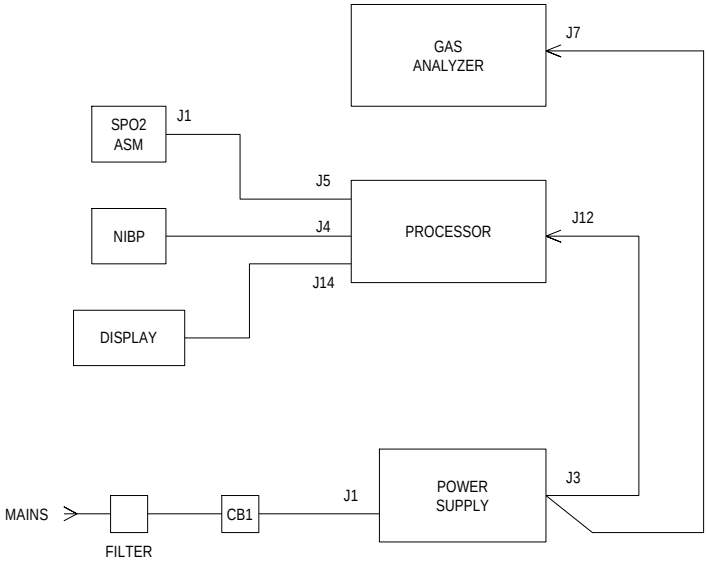


Figure 3-1: VITALERT 3000 VOLTAGE DISTRIBUTION

3.2 Troubleshooting Guides

Table 3-2 lists common failure modes and symptoms (excluding simultaneous multiple faults) for the Vitalert 3000 Series monitors. Each failure mode or symptom is keyed to a troubleshooting guide flow chart on the following pages to assist the TSR in locating a problem.These flow charts assume that the instrument is plugged into an AC outlet with the correct voltage. If a problem occurs that cannot be corrected by following these guides, call DrägerService for support.

TABLE 3-1: POWER SUPPLY VOLTAGES AND TOLERANCES

GAS IF PCB, PWR SUPP WIRE HARNESS	VOLTAGE	ACCEPTABLE RANGE
J7-5 (Pur)	+ 5 VDC	4.85 to 5.15 VDC
J7-3 (Yel)	+ 12 VDC	11.76 to 12.24 VDC
J7-1 (Yel/Wht)	- 12 VDC	-11.76 to -12.24 VDC
J7-4 (Blk)	Common	

TOP VIEW OF VITALERT 3000
WITH COVER REMOVED

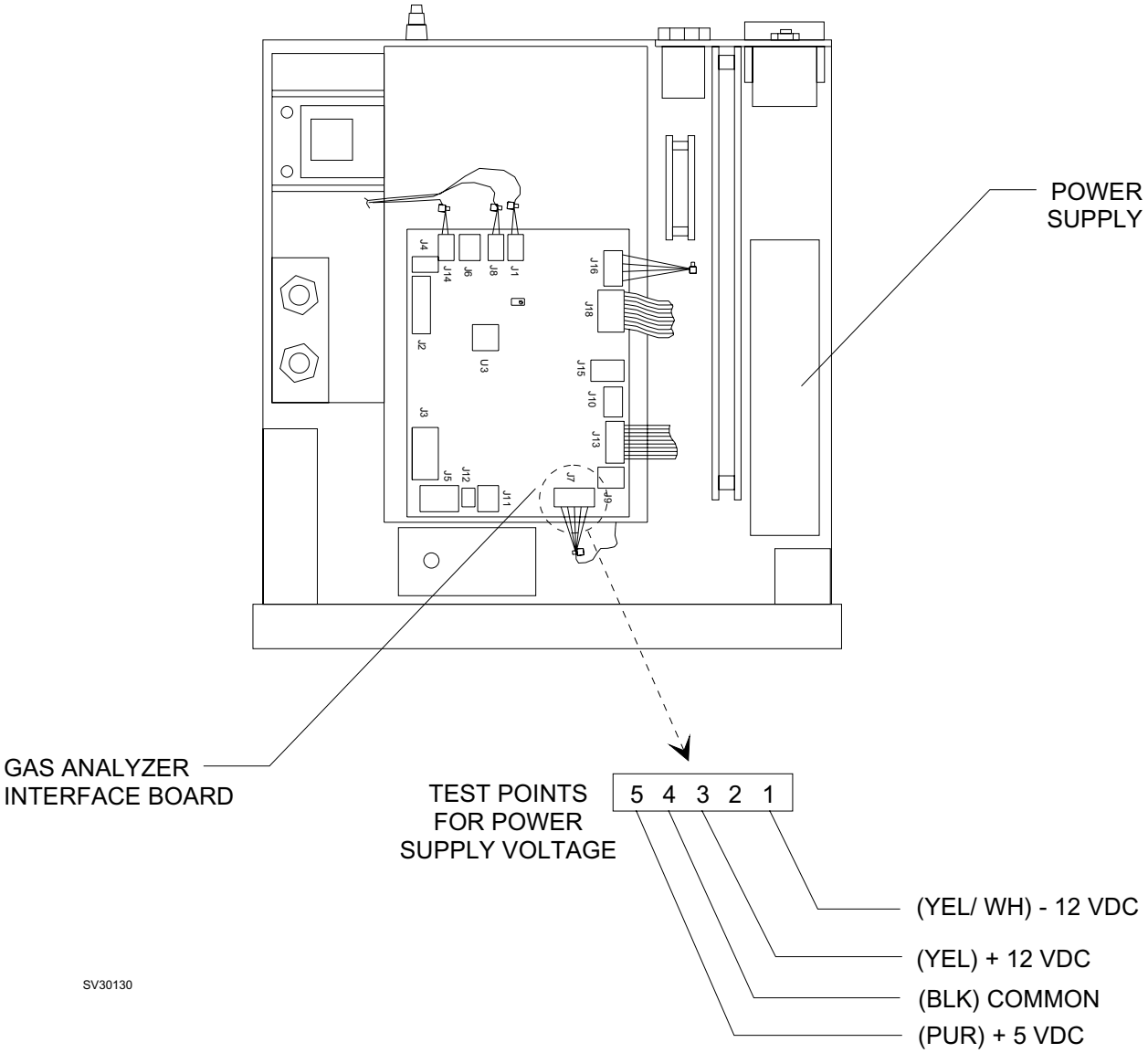
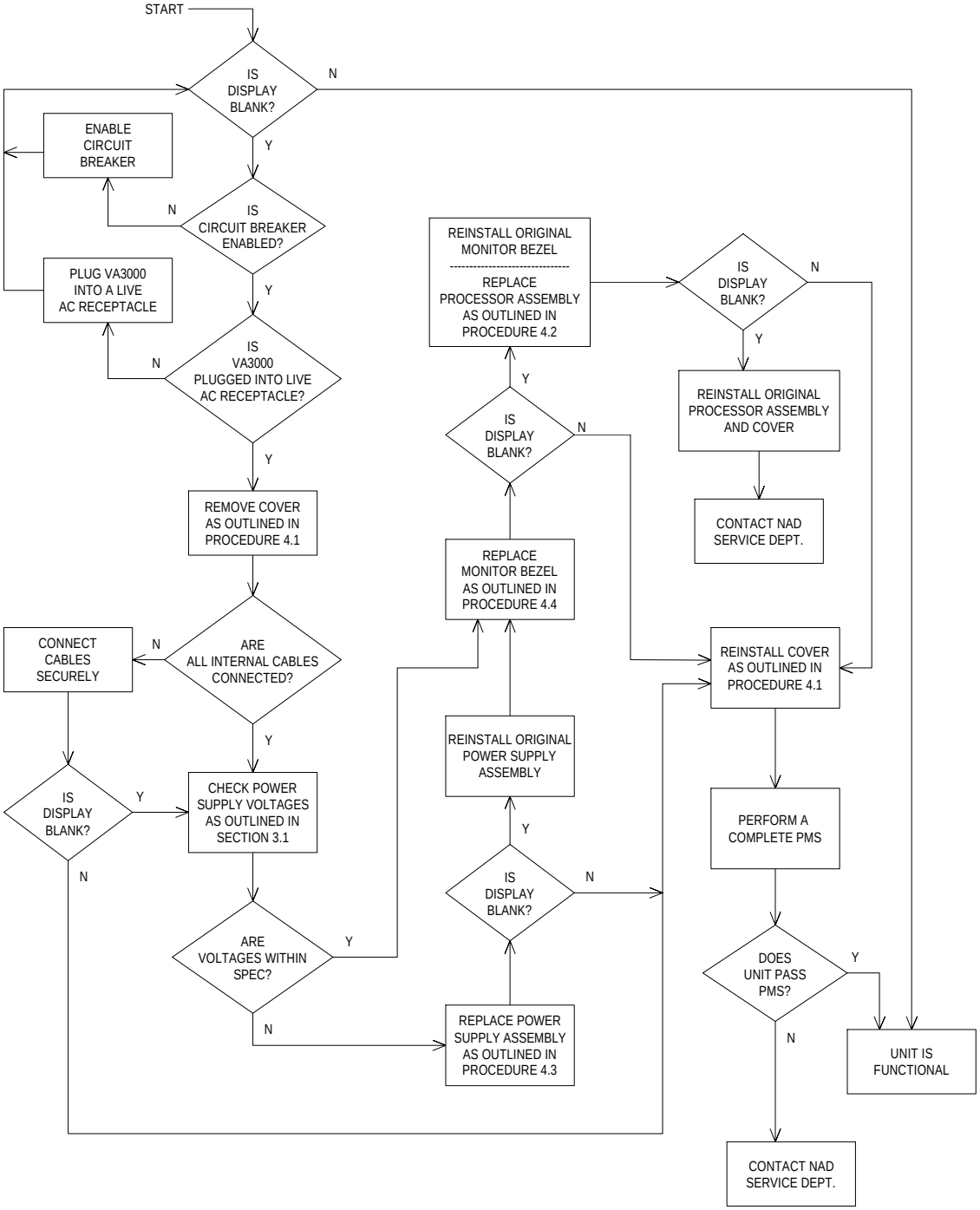


Figure 3-2: POWER SUPPLY TEST POINTS

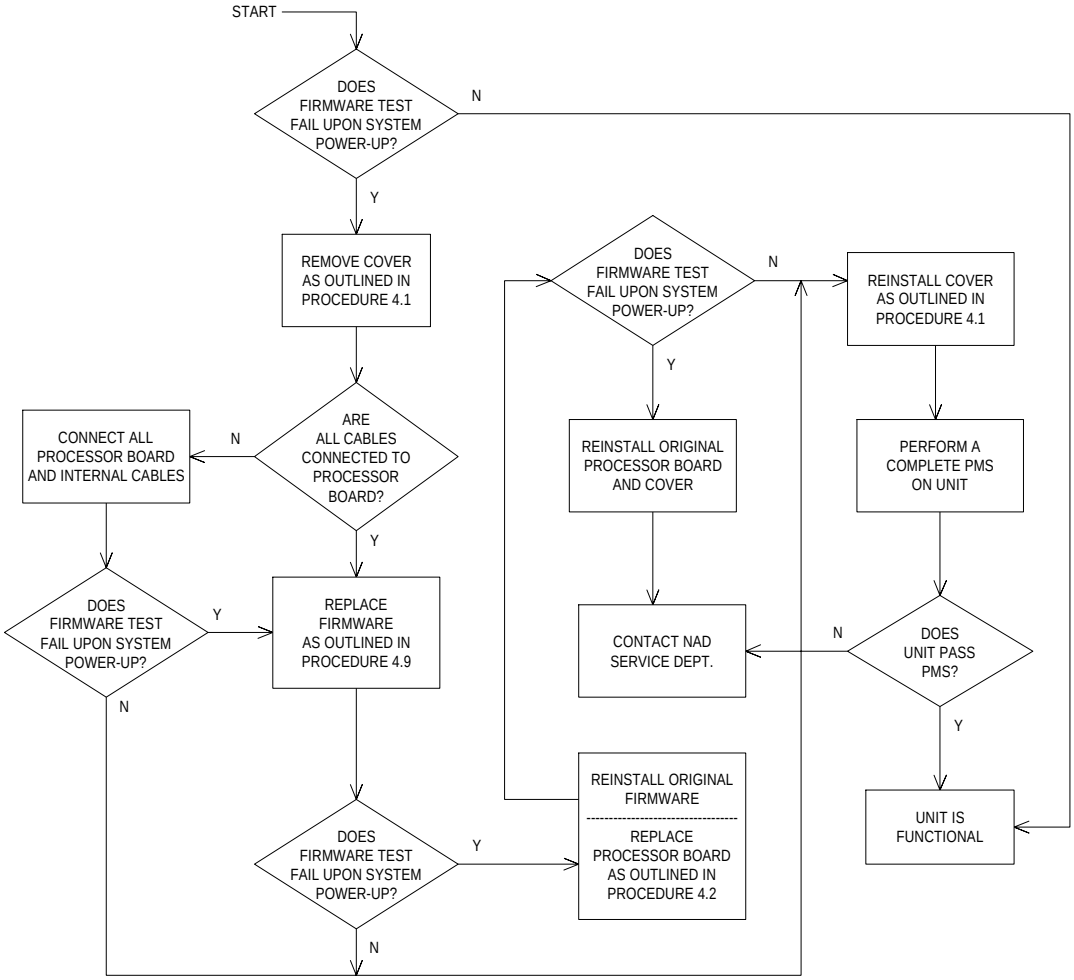
TABLE 3-2: VITALERT 3000 TROUBLESHOOTING GUIDES

FAILURE MODE / SYMPTOM	CORRECTIVE ACTION
Display blank upon system power-up	Guide 1
Firmware Test fails upon system power-up	Guide 2
Video Test fails upon system power-up	Guide 3
Memory Test fails upon system power-up	Guide 4
Timer Test fails upon system power up	Guide 5
Audio Test - Primary fails upon system power-up	Guide 6
Audio Test - Backup fails upon system power-up	Guide 7
Audio Test - SpO_2 fails upon power-up	Guide 8
Serial I/O Test fails upon system power-up	Guide 9
Clock Test fails upon system power-up	Guide 10
NVRAM Test fails upon system power-up	Guide 11
"SERVICE GAS MON" Advisory error	Guide 12
"SERVICE NIBP MON" Advisory error	Guide 13
"SERVICE SPO2 MON" Advisory error	Guide 14
Vitalink failure	Guide 15
Low or No Flow at CO_2 exhaust port	Guide 16
Line Block message displayed	Guide 17
Instrument will not power-up	Guide 18
Front Keys and/or Rotary Dial not functional	Guide 19
NIBP readings inacurate	Guide 20
Instrument is performing intermittent resets	Guide 21
Analyzer fails Span Cal	Guide 22

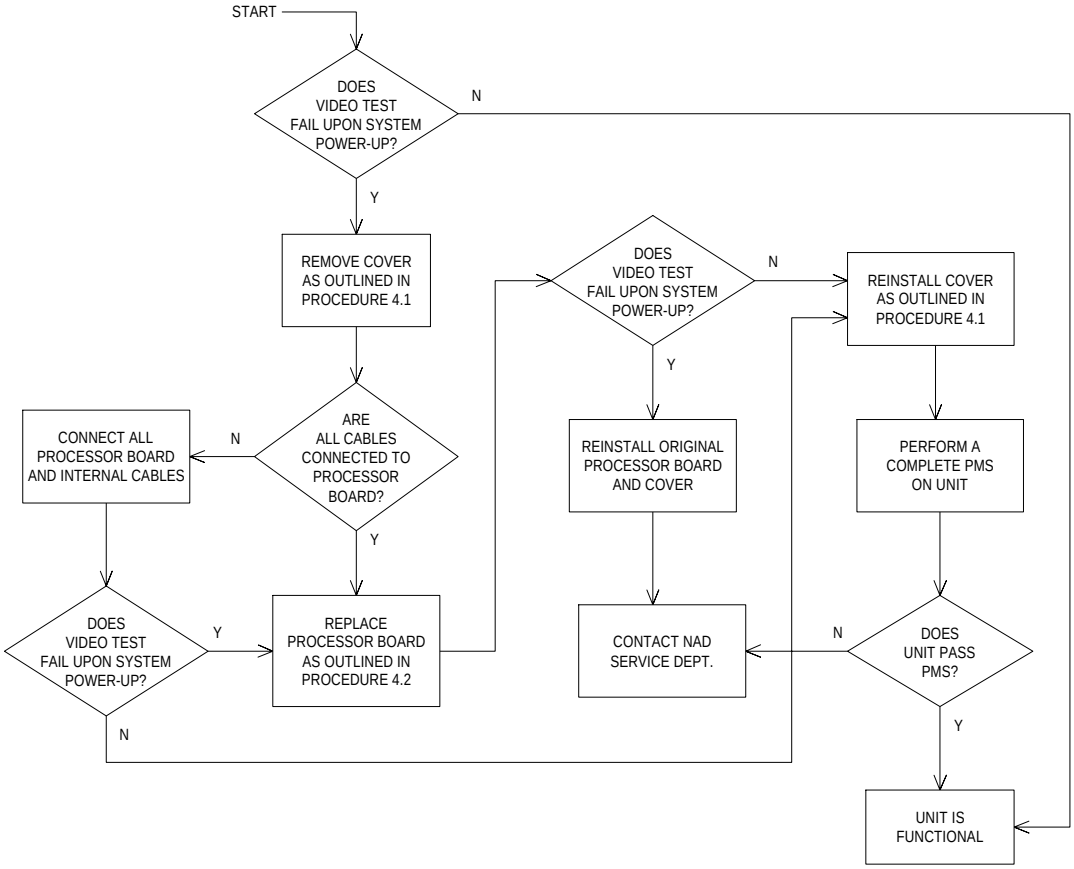
GUIDE 1: Display blank upon system power-up



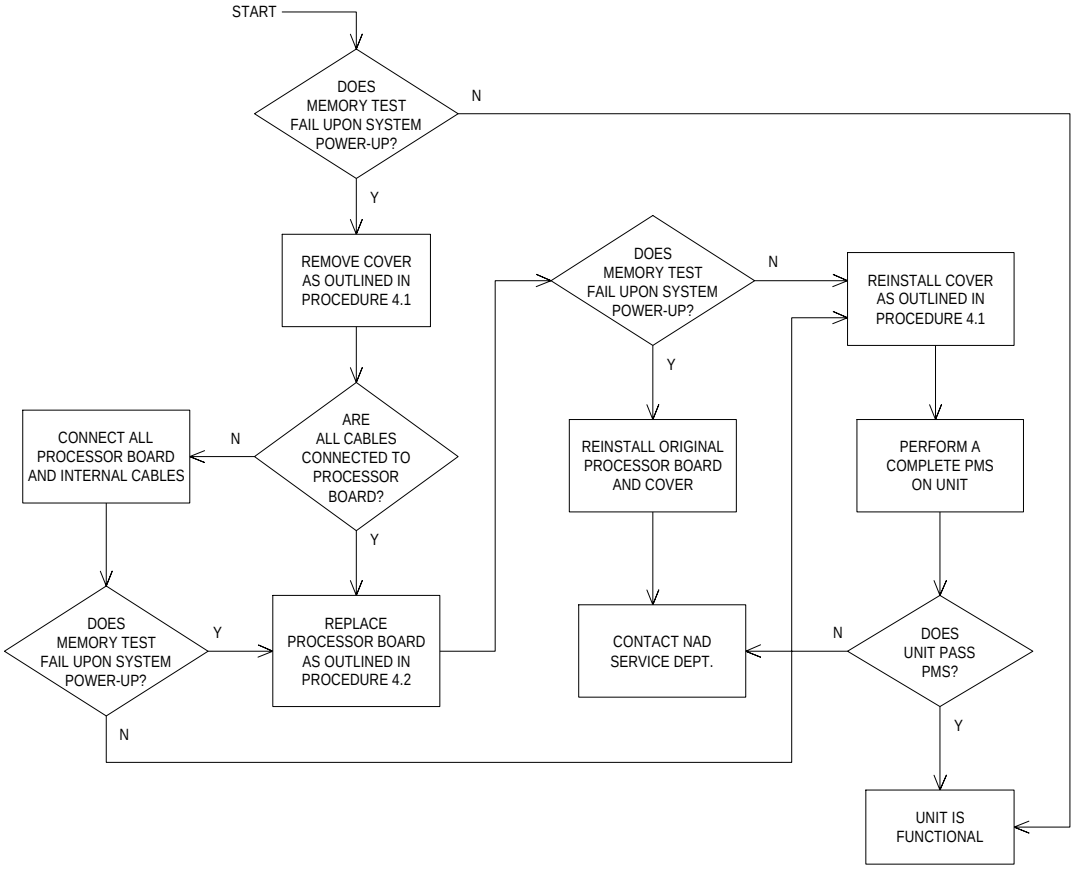
GUIDE 2: Firmware Test fails upon system power-up



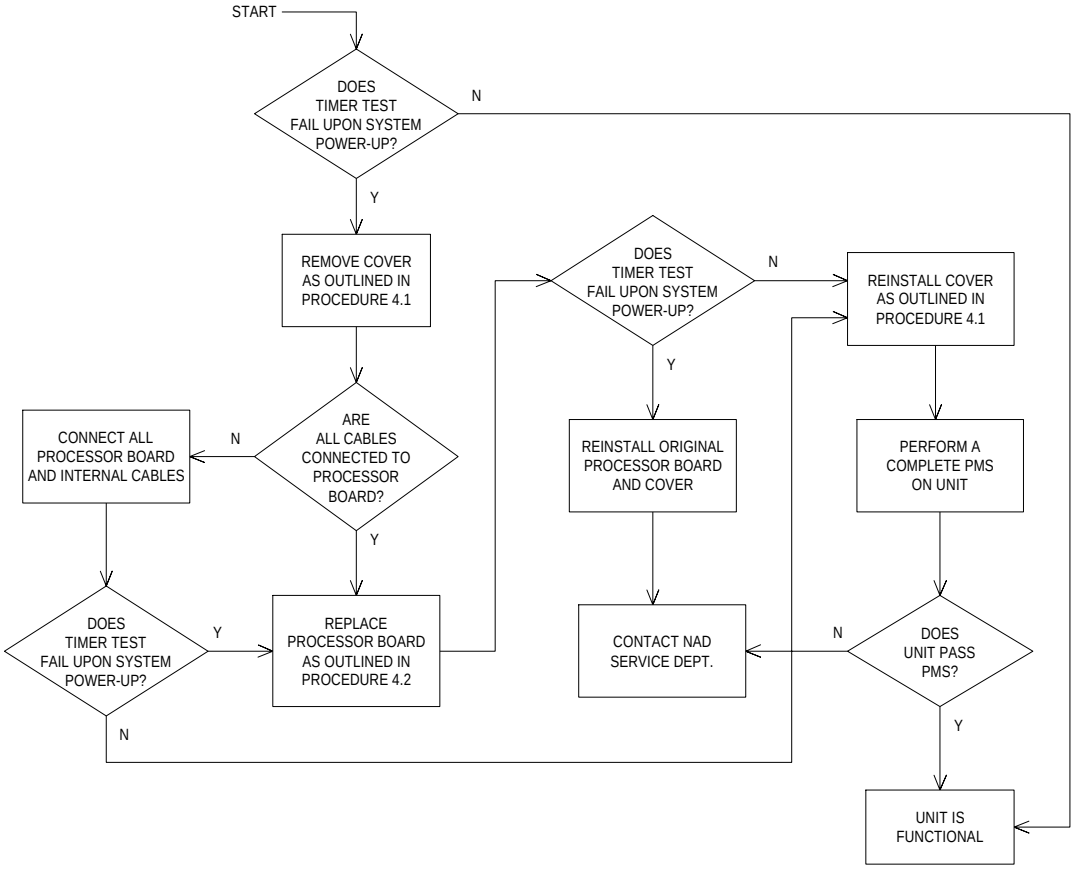
GUIDE 3: Video Test fails upon system power-up



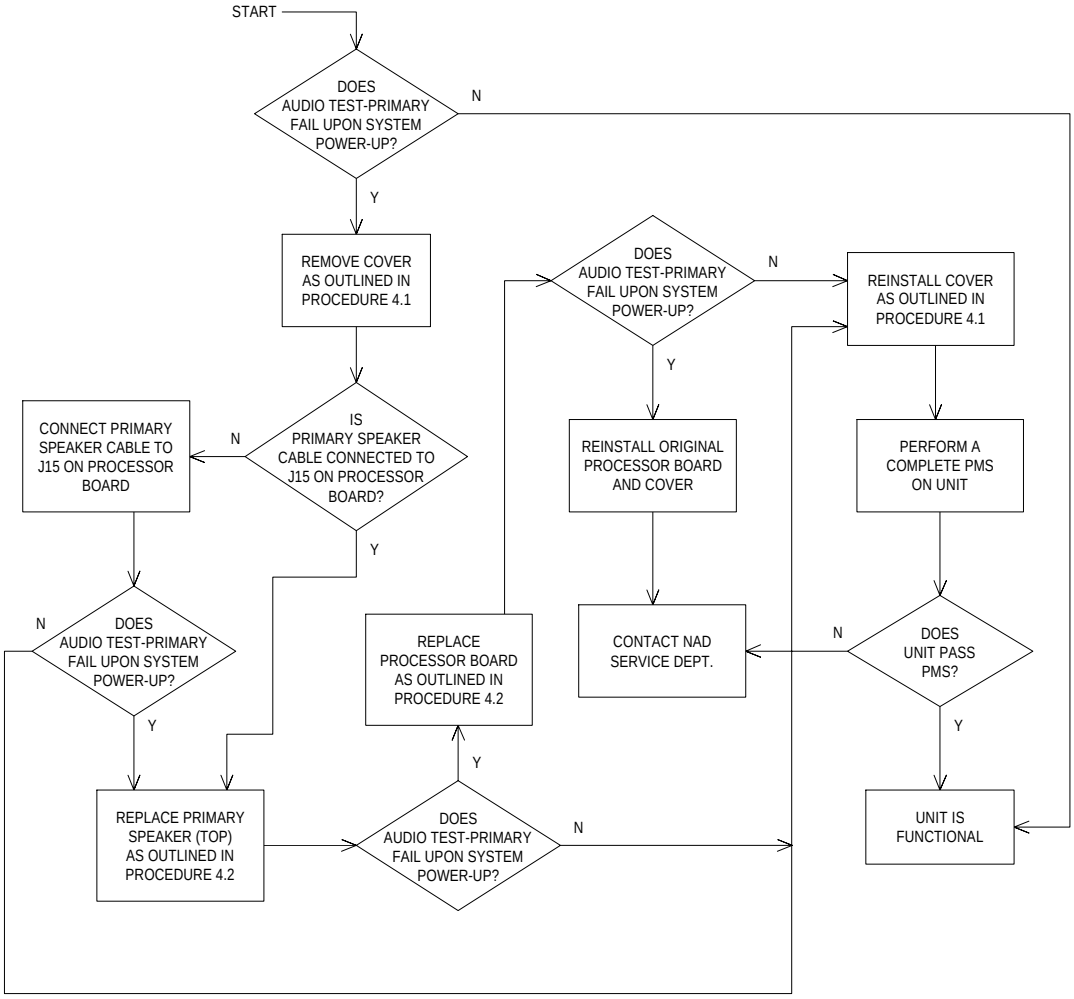
GUIDE 4: Memory Test fails upon system power-up



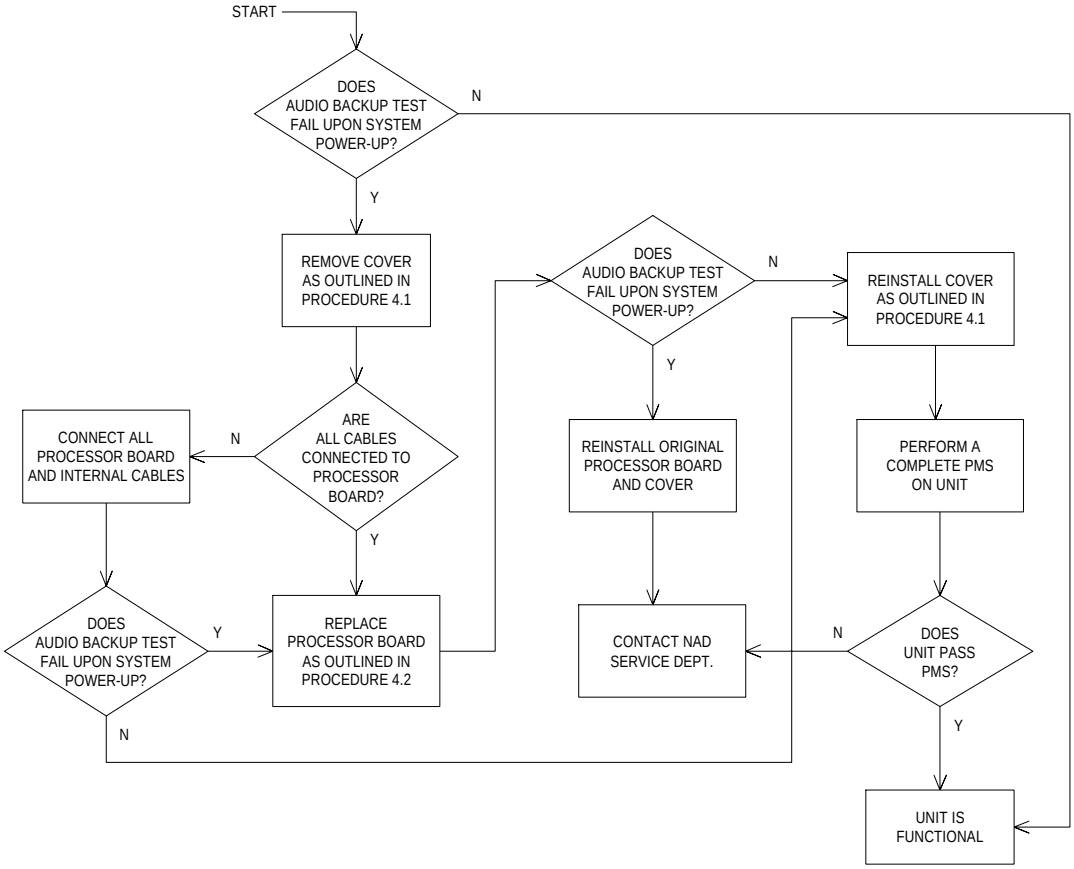
GUIDE 5: Timer Test fails upon system power up



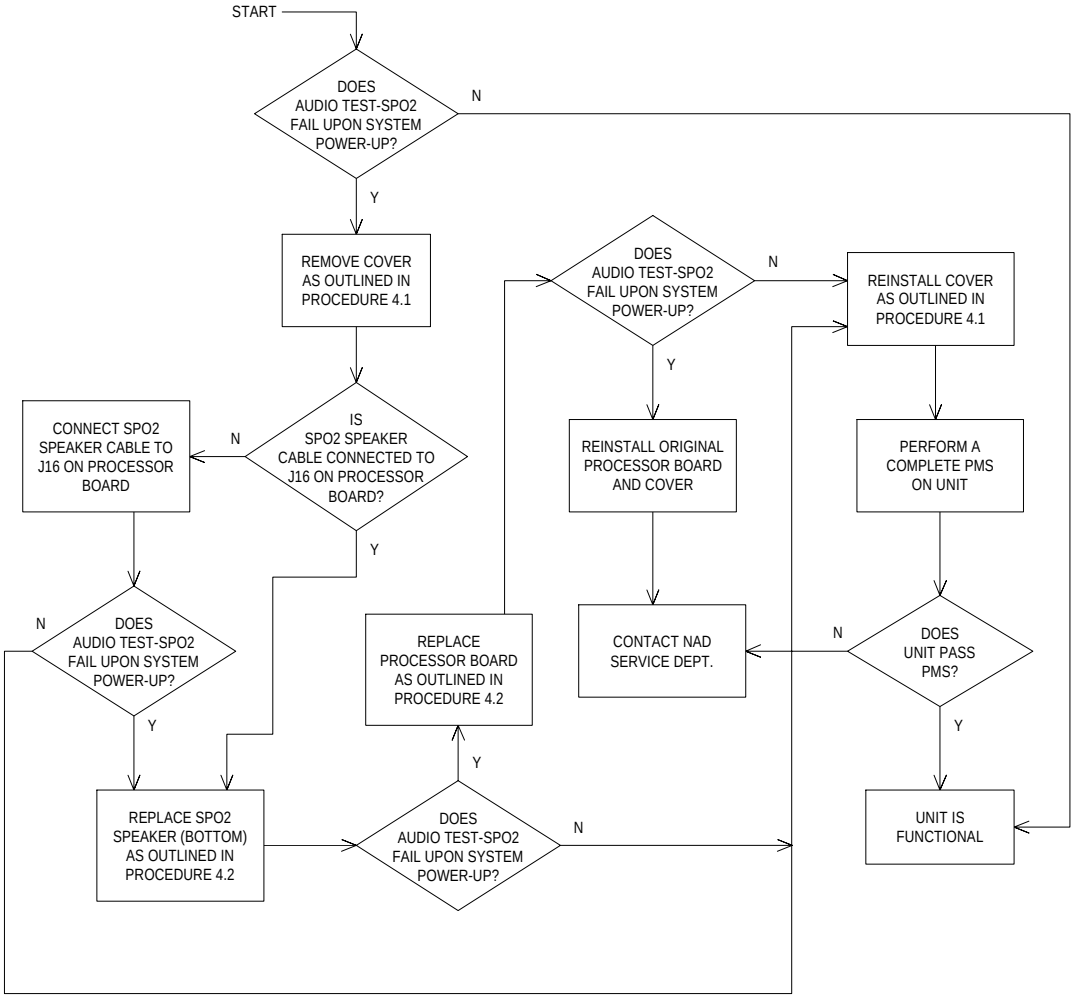
GUIDE 6: Audio Test - Primary fails upon system power-up



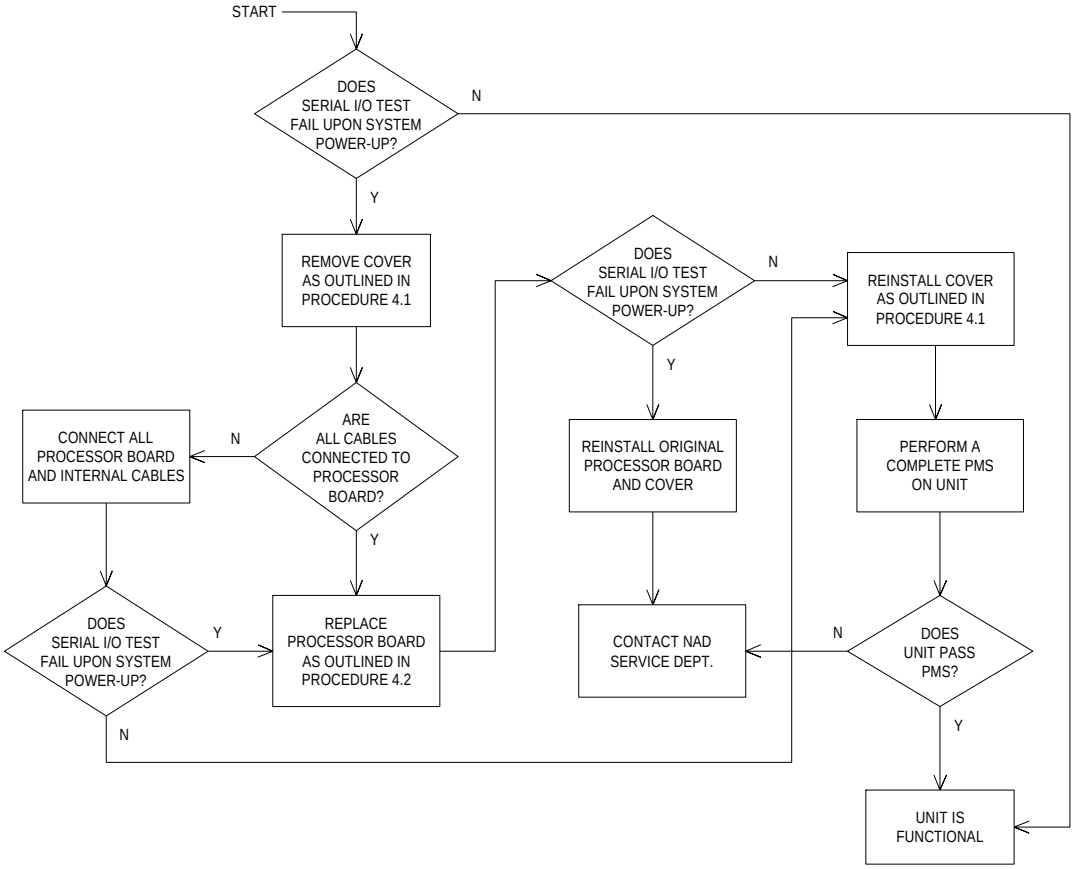
GUIDE 7: Audio Test - Backup fails upon system power-up



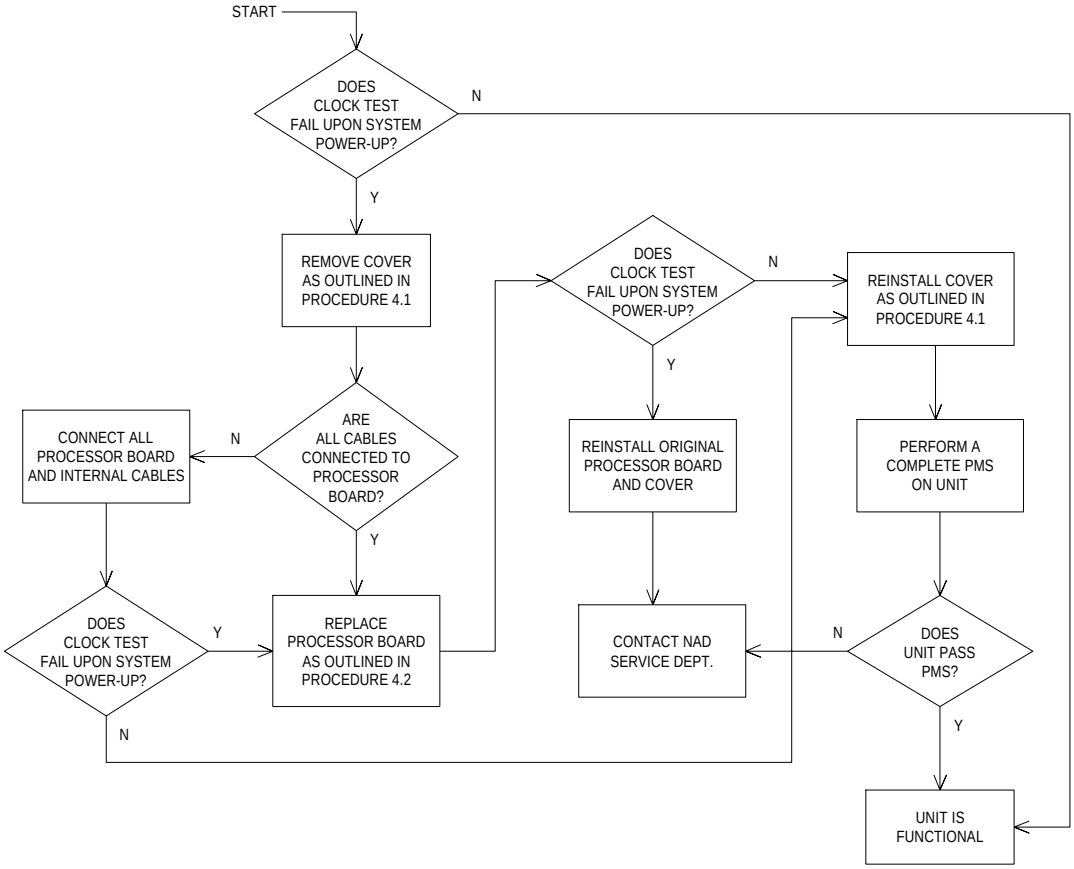
GUIDE 8: Audio Test - SpO_2 fails upon power-up



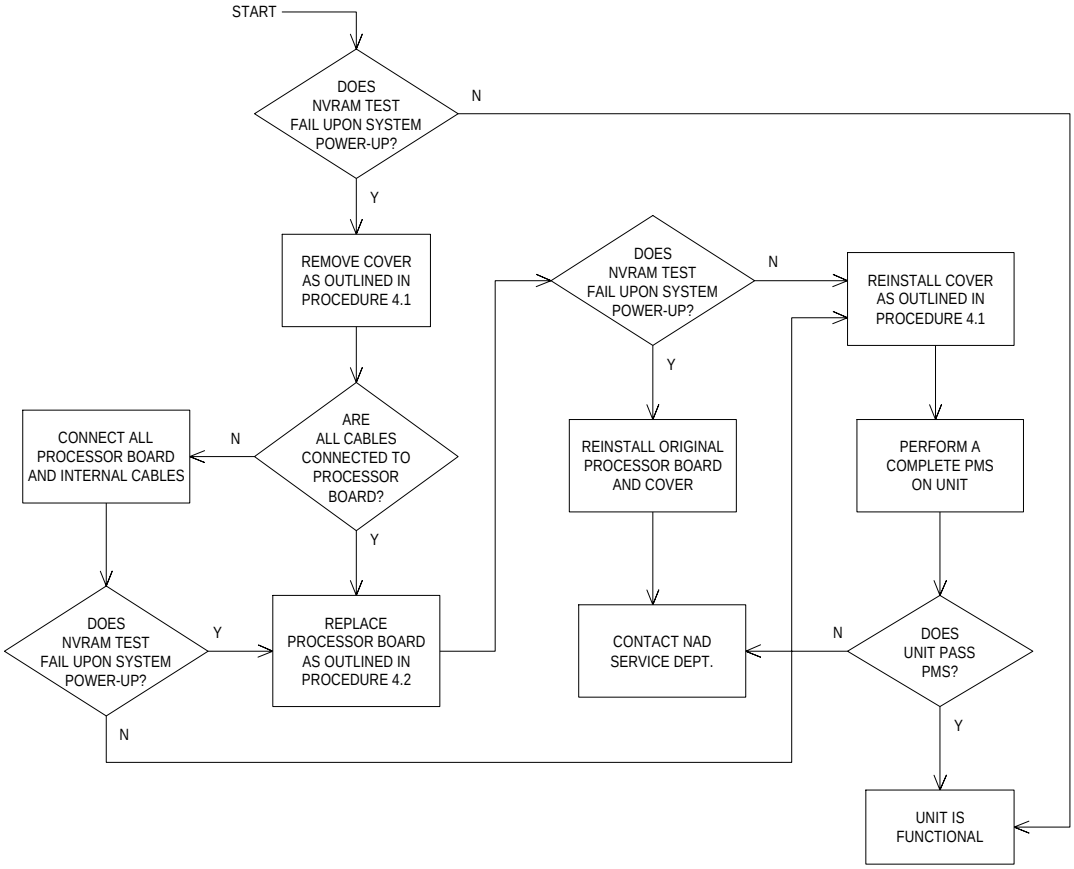
GUIDE 9: Serial I/O Test fails upon system power-up



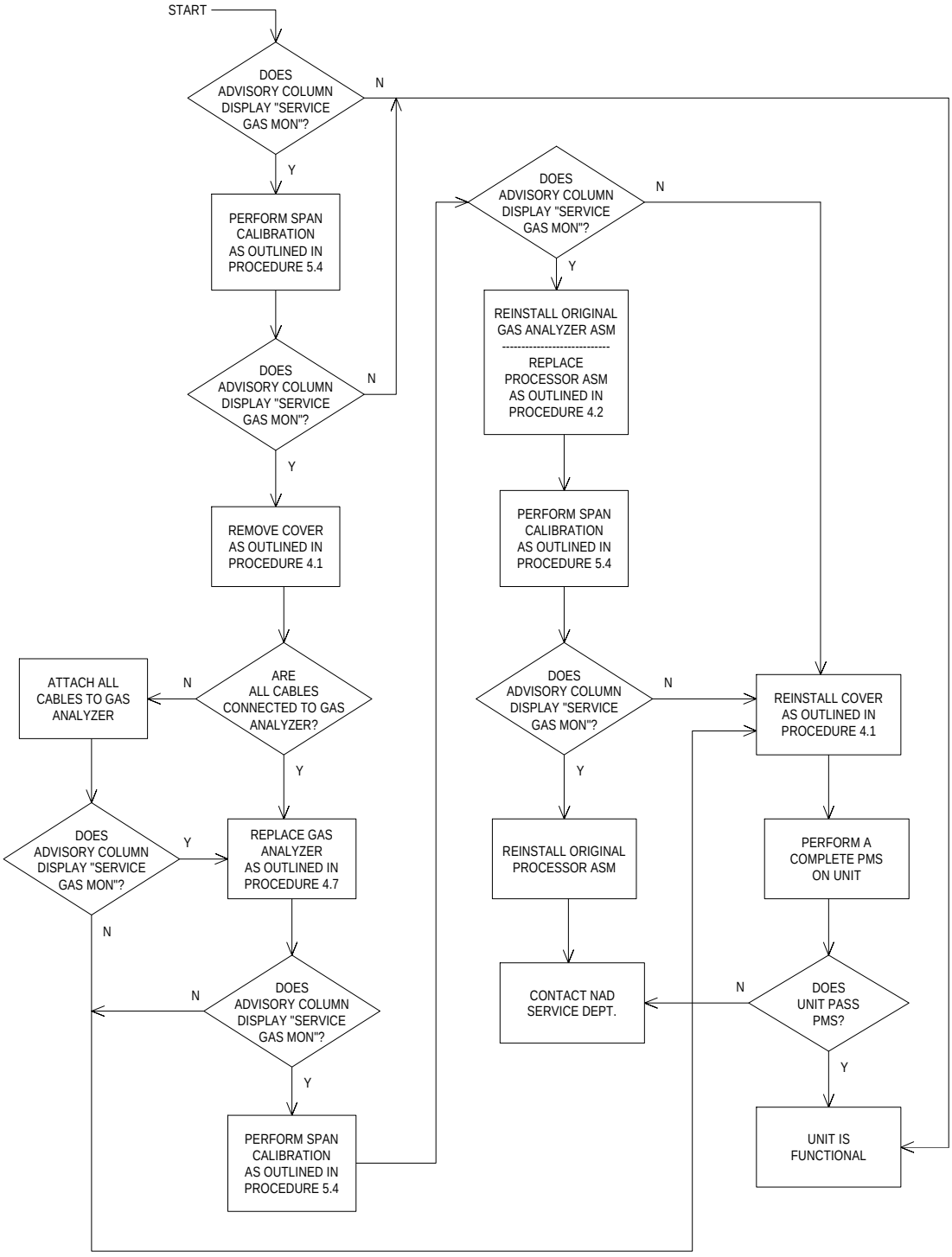
GUIDE 10: Clock Test fails upon system power-up



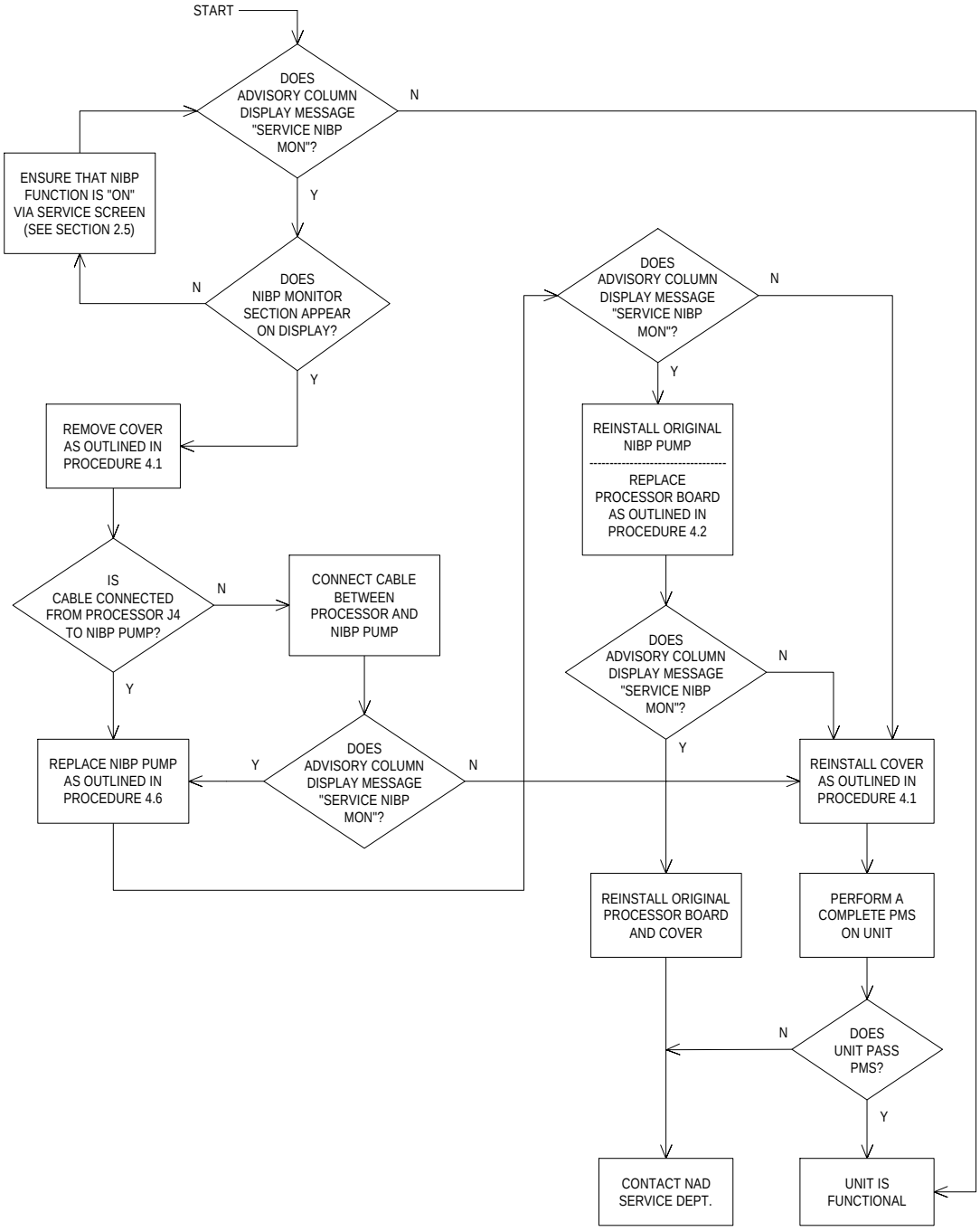
GUIDE 11: NVRAM Test fails upon system power-up



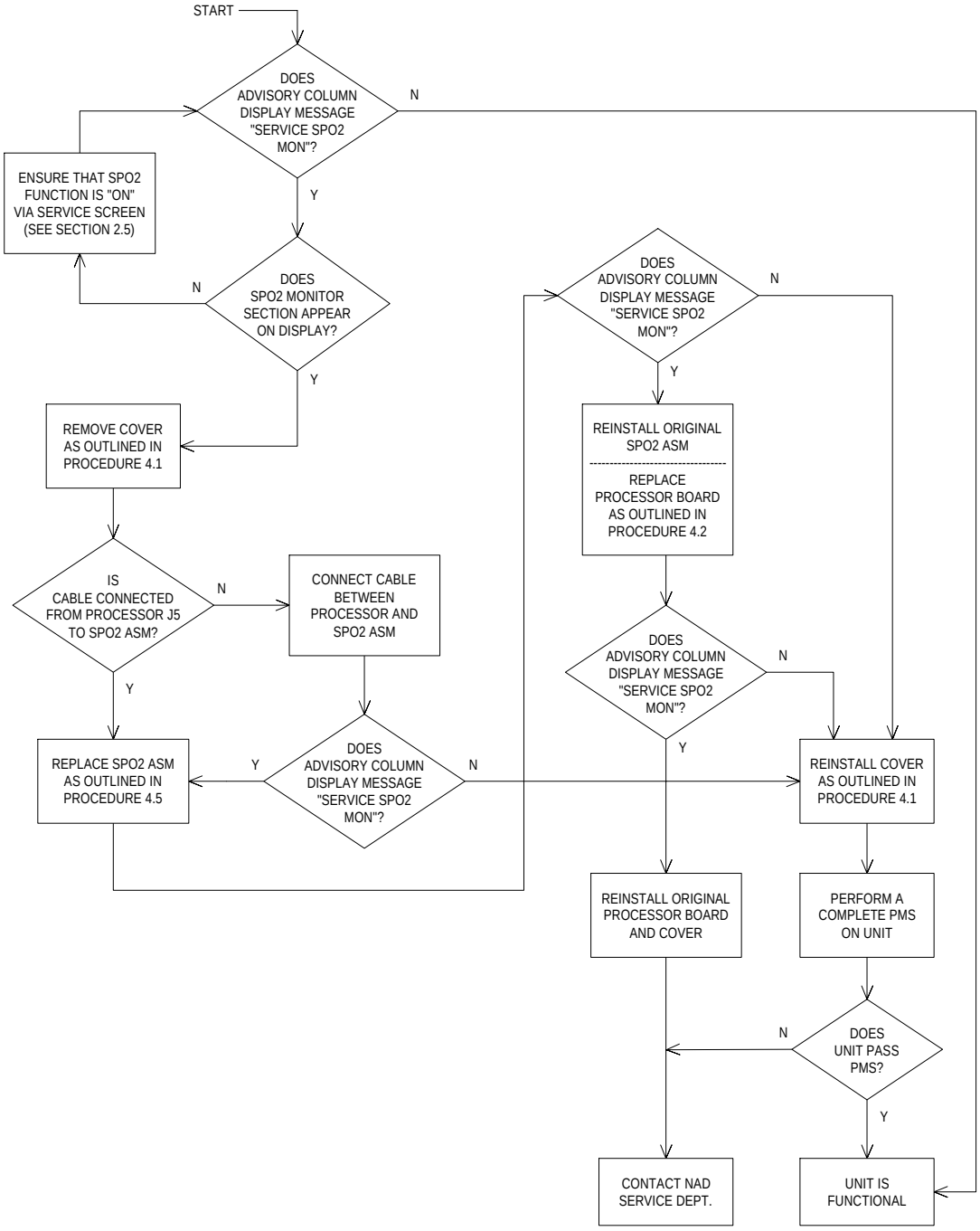
GUIDE 12: "SERVICE GAS MON" Advisory error



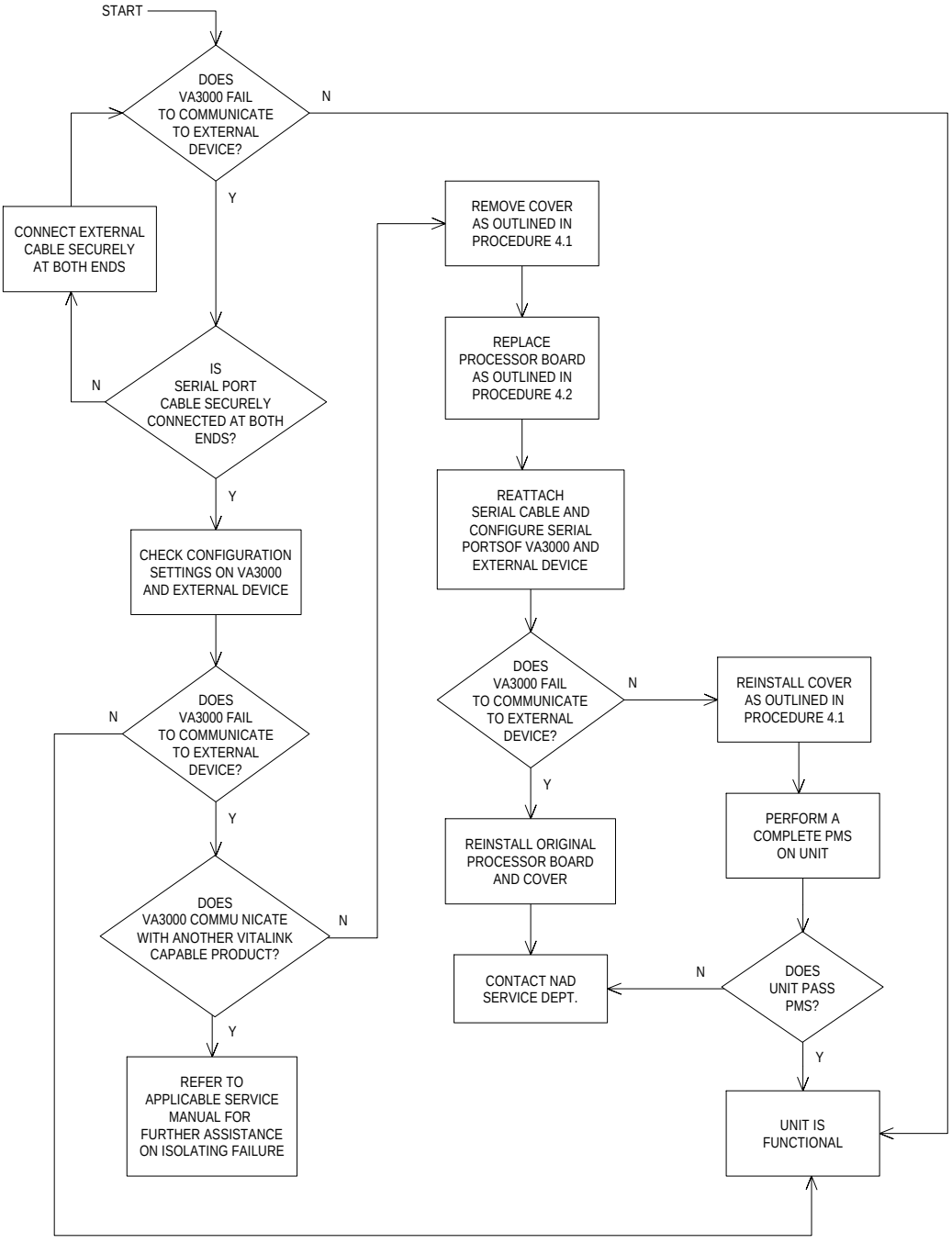
GUIDE 13: "SERVICE NIBP MON" Advisory error



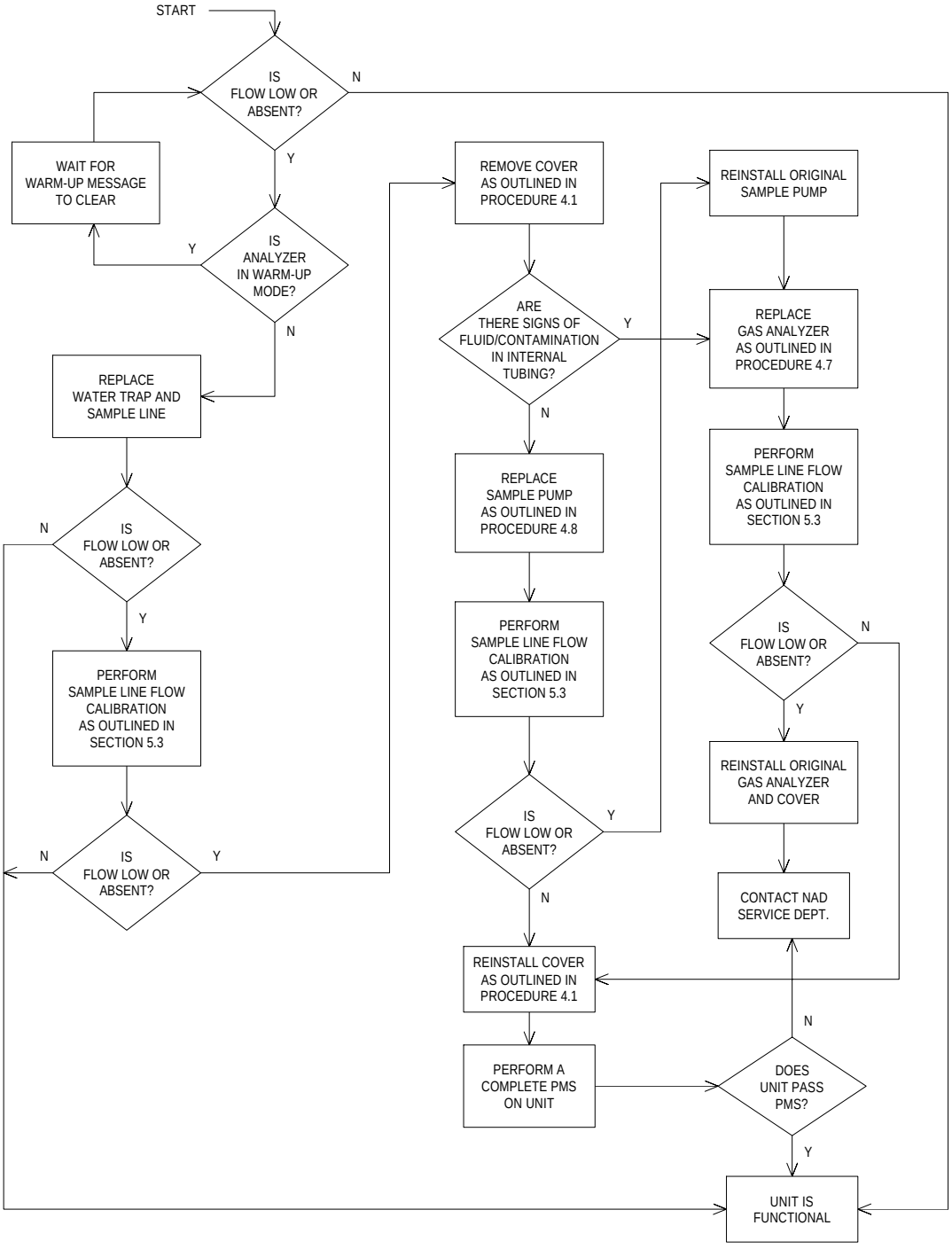
GUIDE 14: "SERVICE SPO2 MON" Advisory error



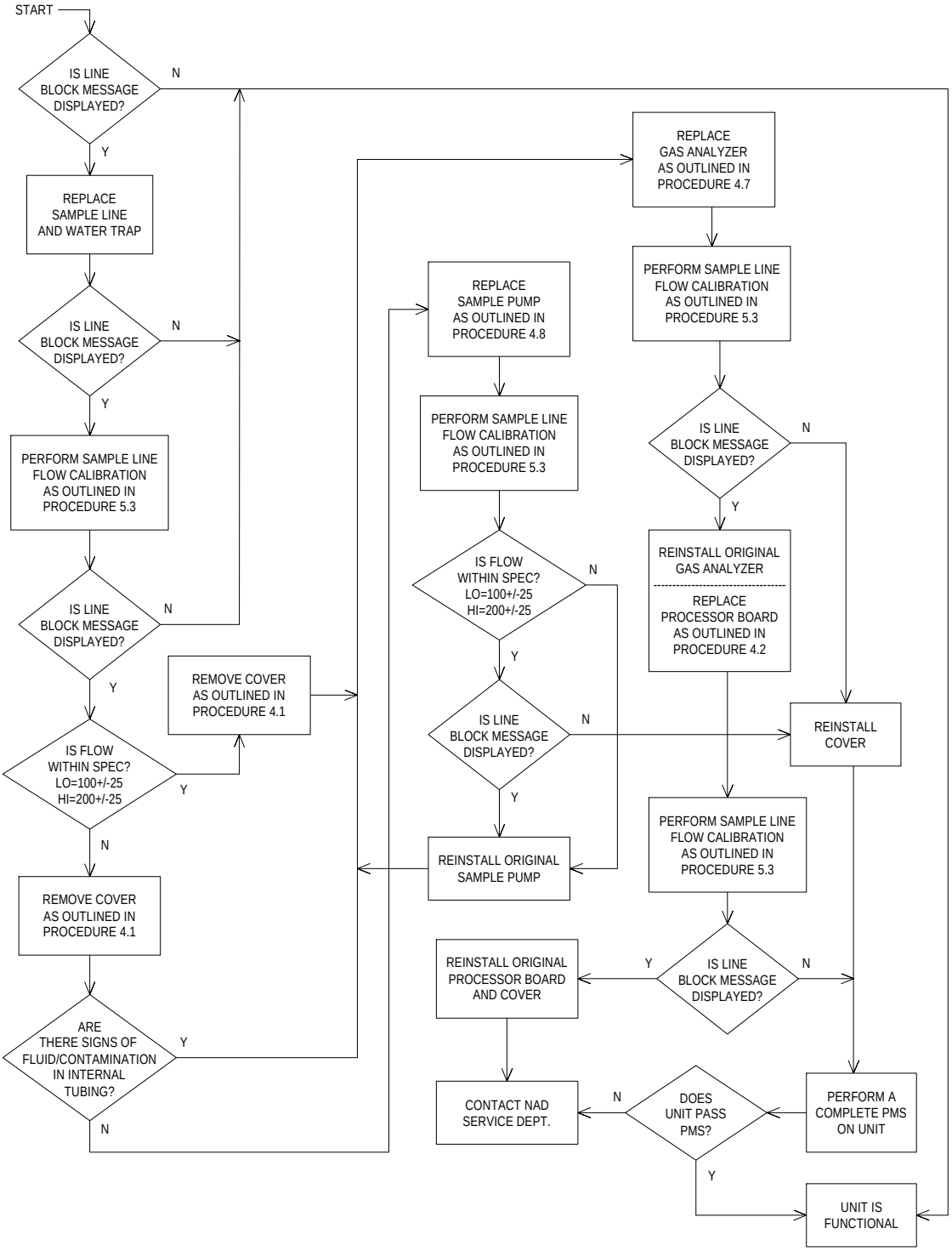
GUIDE 15: Vitalink failure



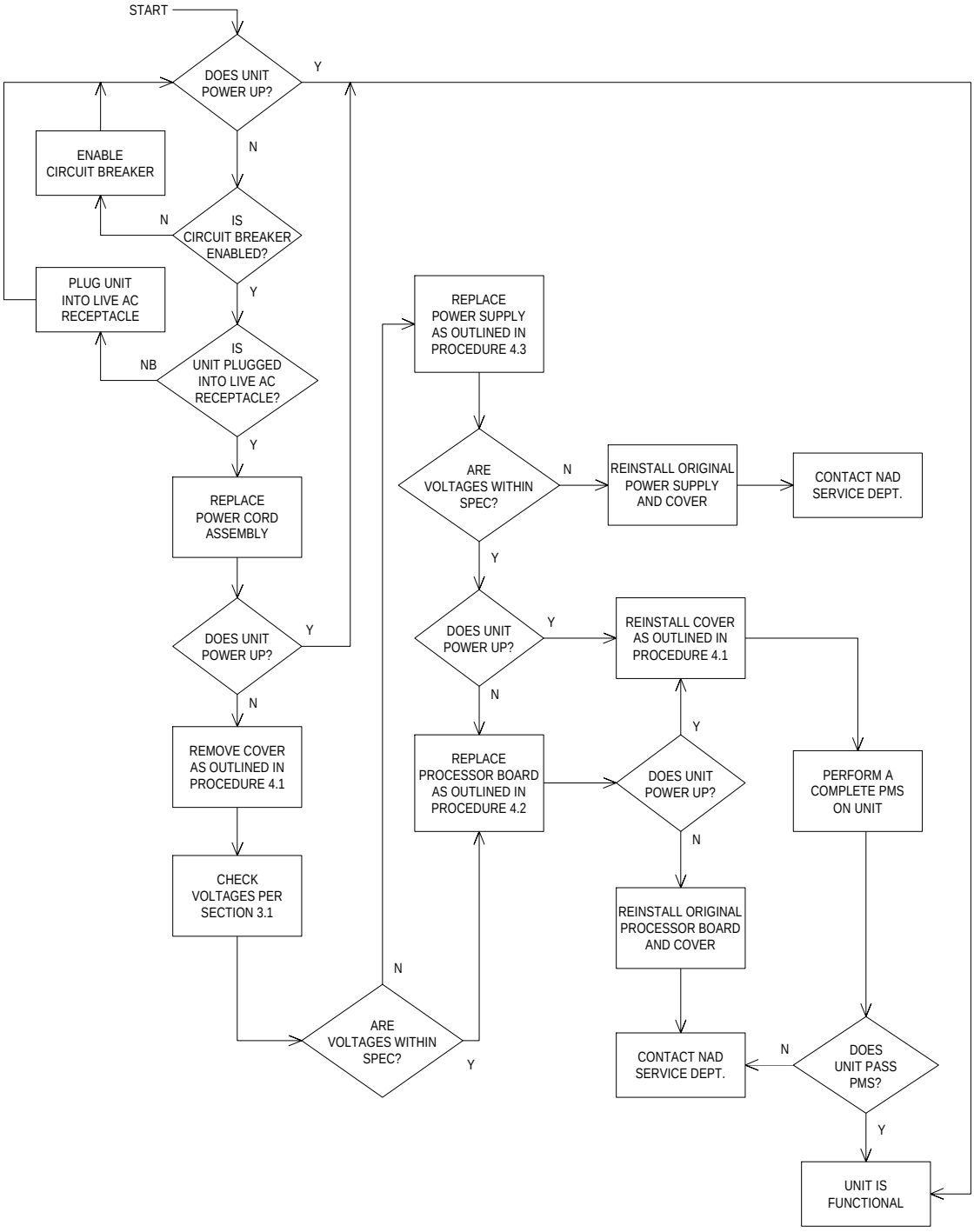
GUIDE 16: Low or No Flow at CO_2 exhaust port



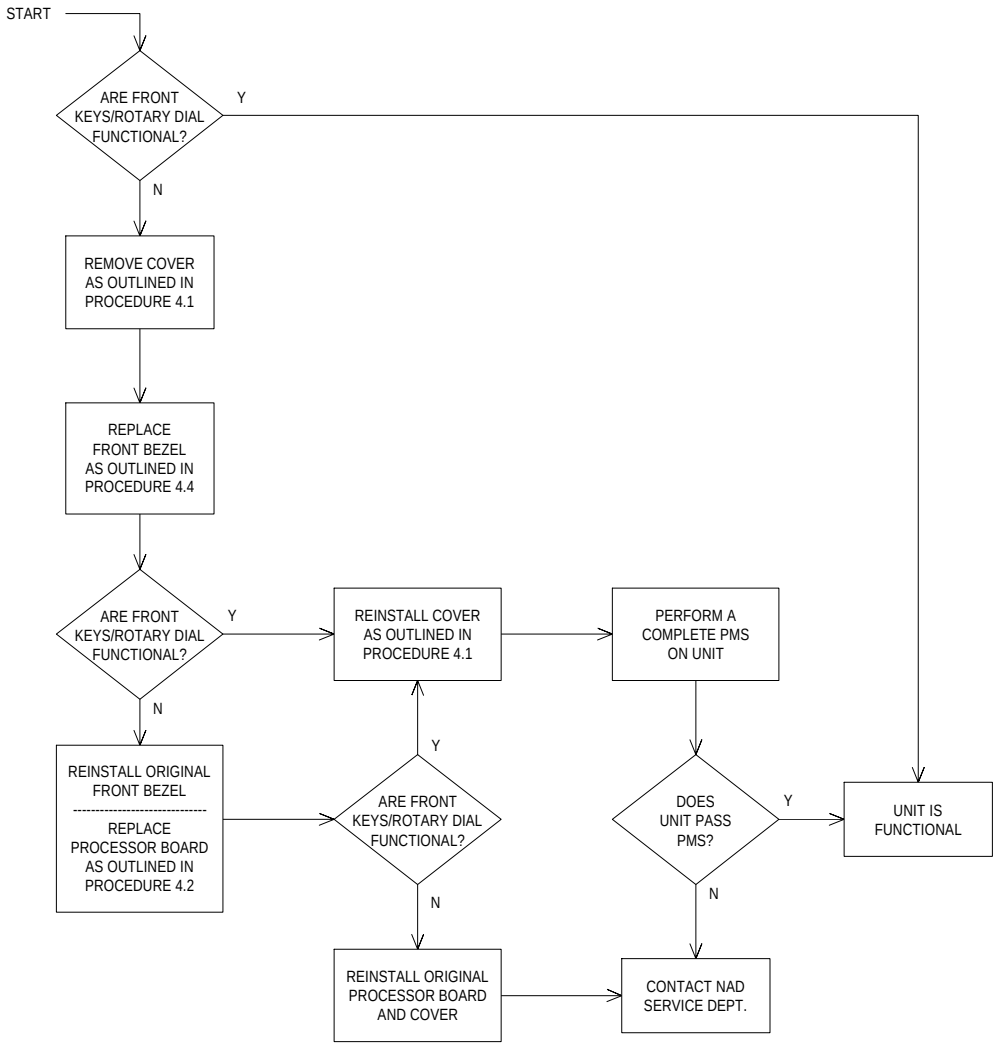
GUIDE 17: Line Block message displayed



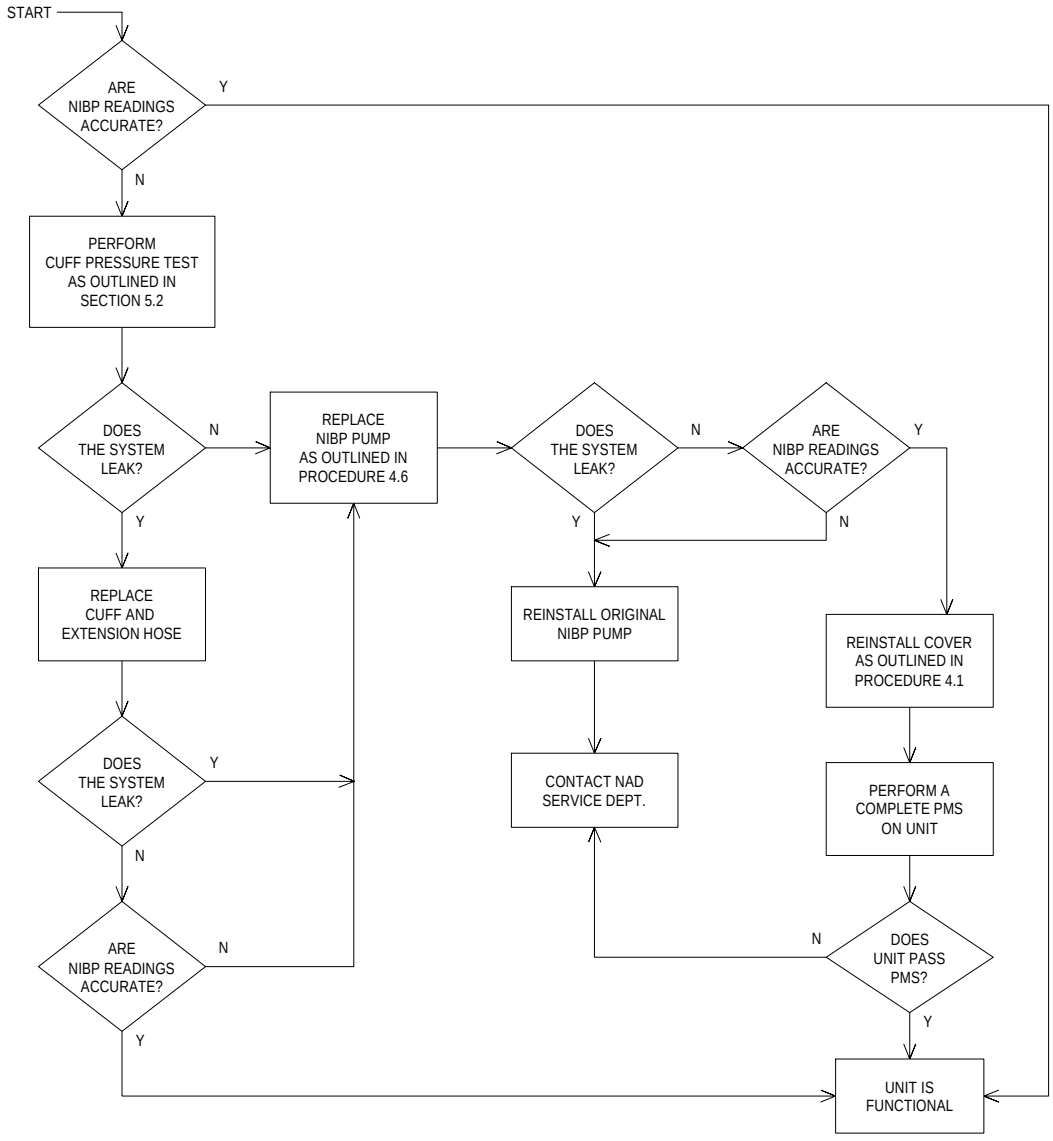
GUIDE 18: Instrument will not power-up



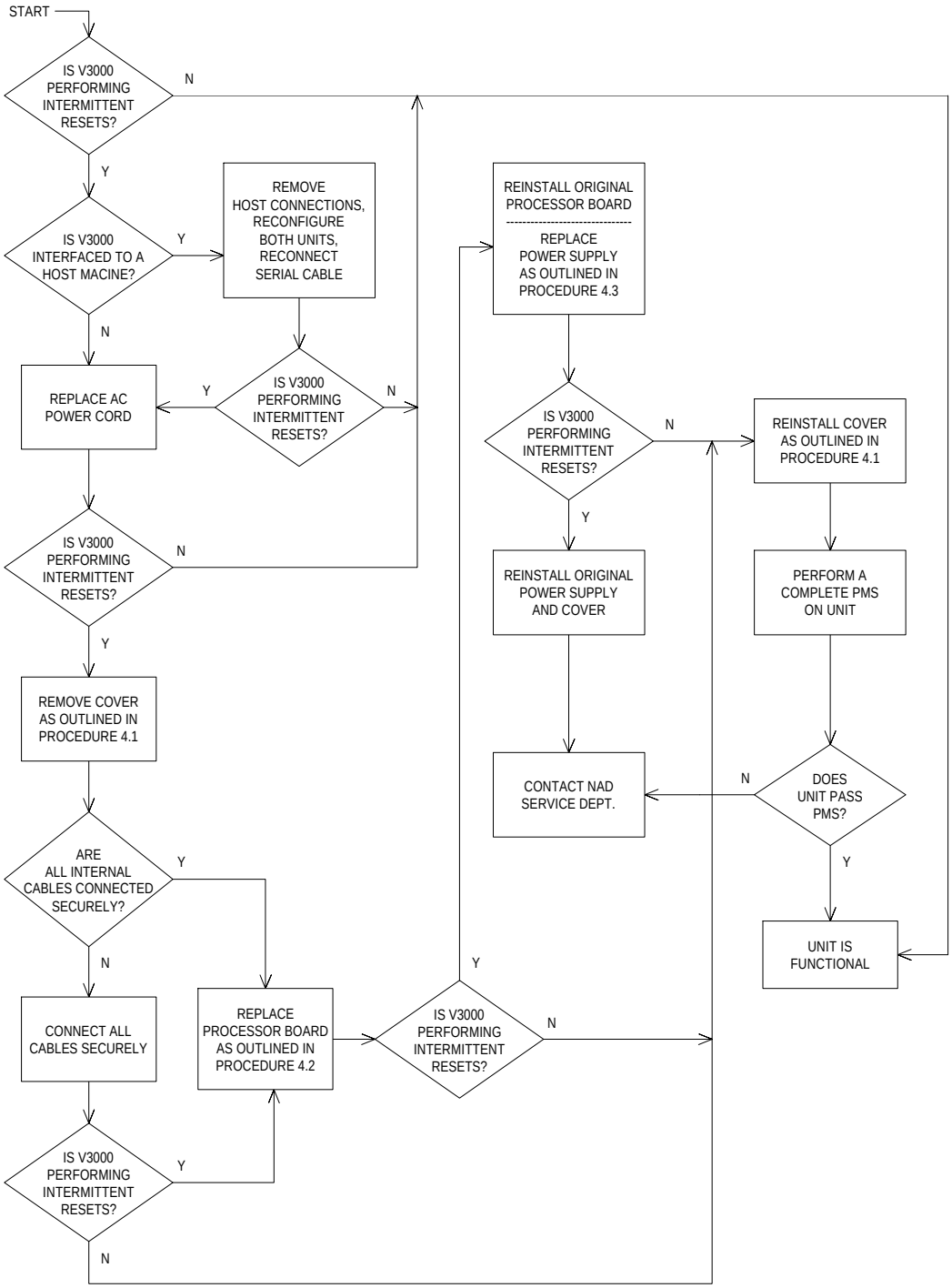
GUIDE 19: Front Keys and/or Rotary Dial not functional



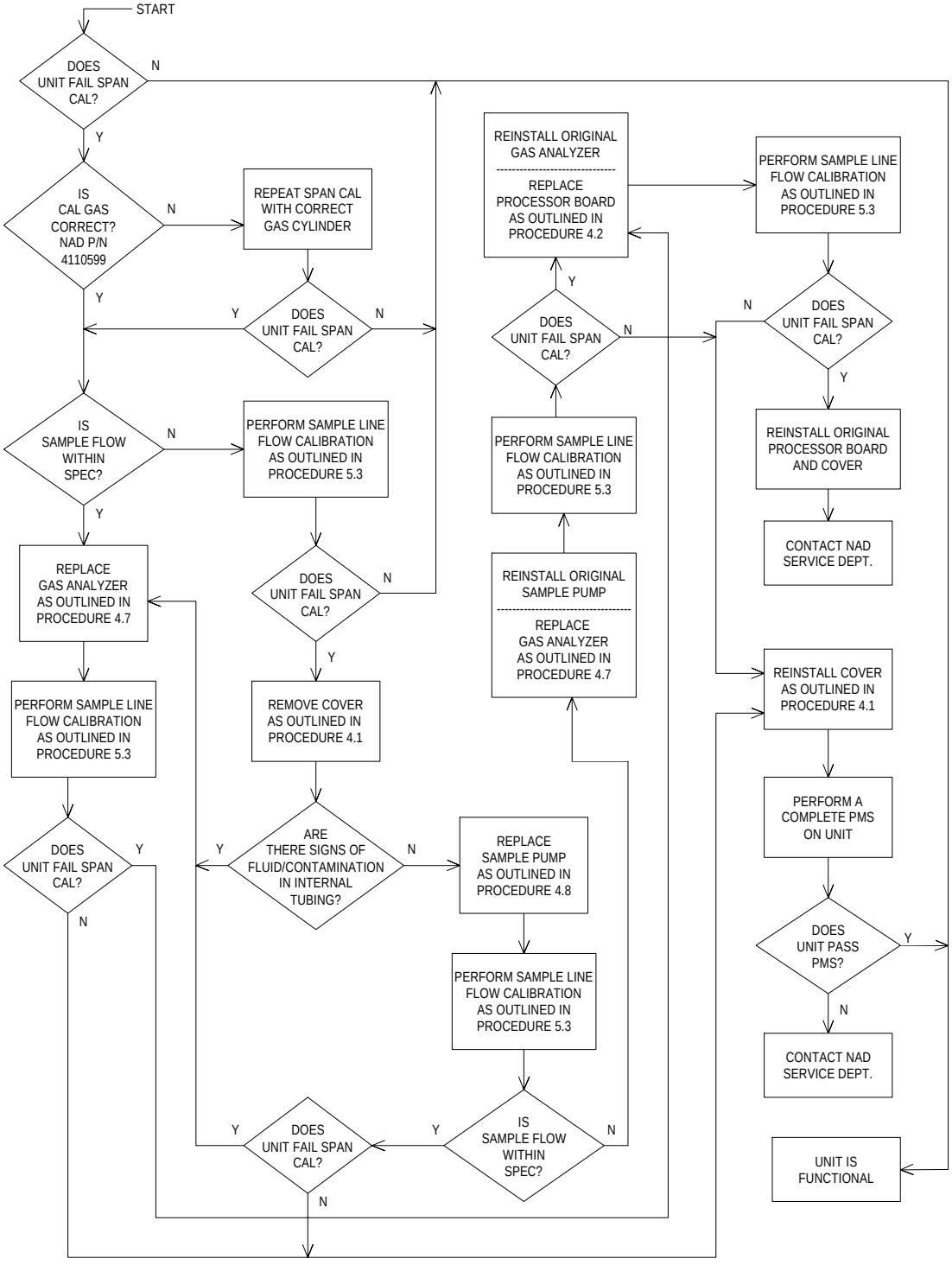
GUIDE 20: NIBP readings inacurate



GUIDE 21: Instrument is performing intermittent resets



GUIDE 22: Analyzer fails Span Cal



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4.0 REPLACEMENT PROCEDURES

This section outlines removal and replacement procedures for the field-replaceable assemblies of the VITALERT 3000 Series Monitoring System.

All procedures are to be performed only by a Draeger Medical, Inc. qualified Technical Service Representative (TSR).

The following replacement procedures are the only procedures authorized by Draeger Medical, Inc. to be performed in the field. All others shall be referred to Draeger Medical Inc.'s Technical Service Department.

NOTE: **The PMS Procedure provided in Section 6 must be performed after any replacement, removal, calibration, or adjustment procedure.**

4.1 VITALERT 3000 Cover

The VITALERT 3000 cover is secured to the underside of the chassis by four button head screws, and to the rear panel by four button head screws. The general arrangement of the cover is shown in Figure 4-1.

4.1.1 Place the instrument in the standby mode, and remove the AC power cord from the instrument.

4.1.2 Disconnect any data cables at the rear panel, and disconnect the exhaust line at the rear panel.

4.1.3 If applicable, disconnect the Pulse Oximeter cable and the BP cuff hose from the patient interface panel on the left side of the instrument.

4.1.4 Disconnect the PVC sample line and remove the air filter from the water trap housing.

4.1.5 Remove the water trap from its holder.

4.1.6 Remove the four button head screws and lockwashers securing the cover to the rear panel.

4.1.7 On a clean working surface, turn the instrument onto its side.

4.1.8 Remove the four button head screws and lockwashers securing the cover to the bottom of the chassis.

4.1.9 Carefully rotate the instrument back to an upright position.

4.1.10 On the left side of the instrument, pull the bottom of the cover outward far enough to clear the water trap housing while sliding the cover towards the rear of the chassis until the cover is clear of the chassis.

.....

4.1.11 Following adjustment or repair, position the cover at the rear of the chassis and slide it towards the front. Pull the left side of the cover outward as needed to guide it past the water trap housing.

4.1.12 Turn the instrument onto its side and reinstall the four button head screws and lock washers that were previously removed.

4.1.13 Rotate the instrument back to an upright position.

4.1.14 Reinstall the four button head screws and lock washers that were previously removed at the rear of the cover.

NOTE: On later model gas analyzers the Luer fitting in the water trap housing and the Luer fitting on the PVC sample line have a different gender arrangement than previous models. The later arrangement prevents connection of the PVC sample line to the water trap housing without an air filter. (The same air filter is used - oriented 180° from the previous arrangement.)

4.1.15 Reinstall the water trap and the air filter, and reconnect the PVC sample line.

4.1.16 If applicable, reconnect the Pulse Oximeter cable and the BP cuff hose at the patient interface panel.

4.1.17 Connect the AC power cord to the instrument.

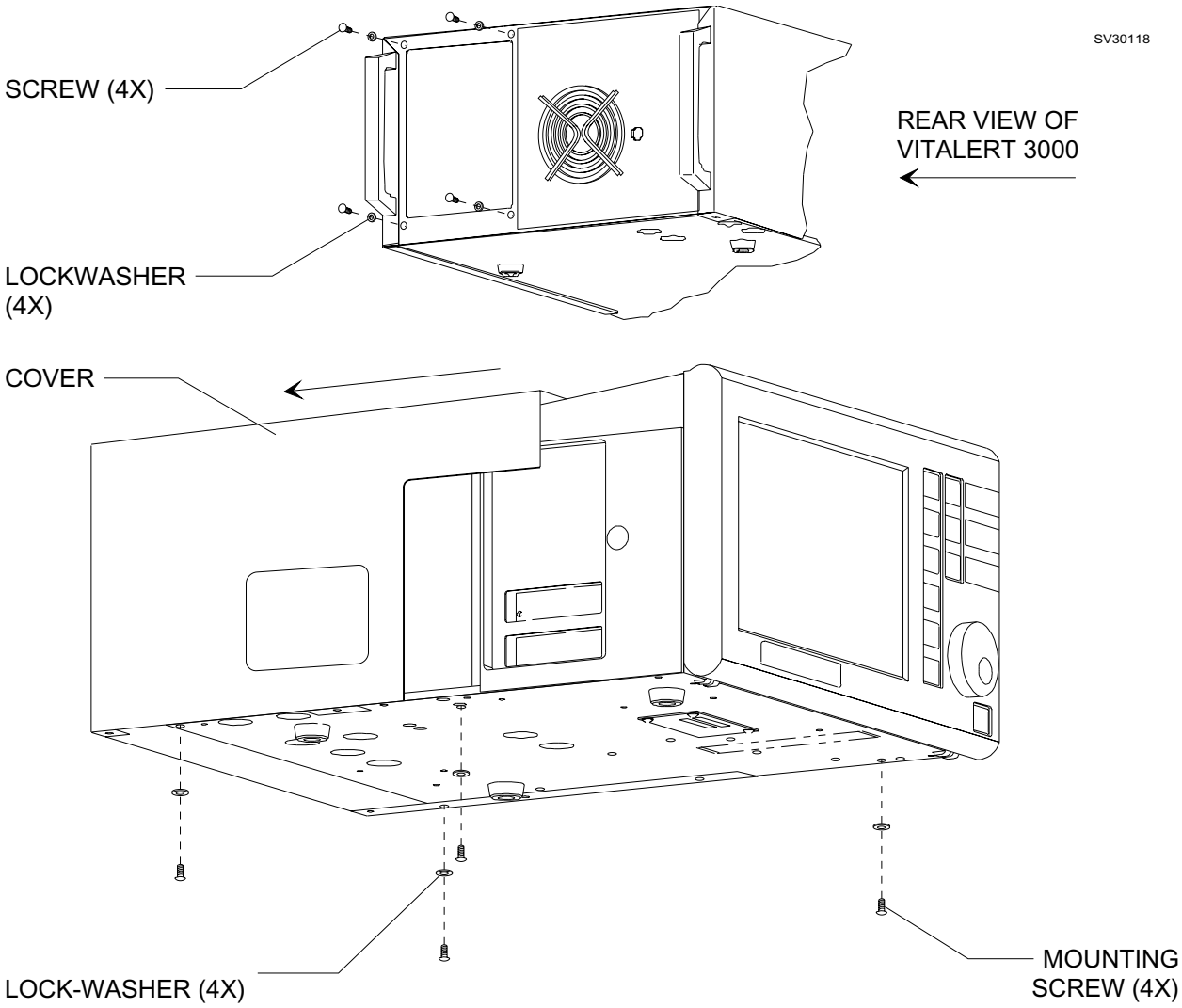


Figure 4-1: VITALERT 3000 COVER REMOVAL

4.2 Processor Assembly

The VITALERT 3000 processor assembly includes the processor board and the rear panel components - speakers, mains filter and circuit breaker - which are replaceable without removing the processor assembly from the chassis. (The serial port connecting through the rear panel are part of the processor board.) Figures 4-2 and 4-2A illustrate the mounting arrangement and connections to the processor assembly.

CAUTION: The processor board contains static-sensitive devices. Use ESD protection when handling this assembly.

NOTE: If possible, document Standard Site and all other stored default template parameters for restoring in replacement processor.

4.2.1 Remove the cover as outlined in Procedure 4.1.

4.2.2 Disconnect the following from the processor board:

J11 (Wire harness - front panel encoder)
J13 (Ribbon cable - front switch panel)
J14 (Ribbon cable - display)
J10 (Ribbon cable - gas analyzer)
J12 (Wire harness - power supply): cut the tie strap
J4 (Ribbon cable - NIBP module)
J5 (Ribbon cable - SpO_2 assembly)

4.2.3 Disconnect the input wire harness at J1 on the power supply.

4.2.4 Disconnect the ground wires at the right rear corner of the chassis.

4.2.5 Remove the processor assembly mounting screws from the underside of the chassis, and carefully lift the processor assembly from the chassis.

Speaker Replacement Only:

- Carefully disconnect the wire harness from the speaker to be replaced. Note the wire color and (+) terminal mark on the speaker so that the replacement speaker can be installed in the same manner.

- Un-screw the speaker mounting ring and remove the speaker from the back panel.

- Install the replacement speaker in the back panel of the processor assembly and secure it with its mounting ring.

- Connect the wire harness to the replacement speaker.

4.2.6 Position the replacement processor assembly in the chassis, and secure the assembly with the screws and lock washers that were previously removed.

4.2.7 Reconnect the ground wires in the same manner as original.

4.2.8 Reconnect the input wire harness to J1 on the power supply.

4.2.9 Reconnect all cables and wire harnesses that were previously disconnected from the processor board.

4.2.10 Install a new tie strap at J12 in the same manner as the original.

4.2.11 Reinstall the cover as outlined in Procedure 4.1.

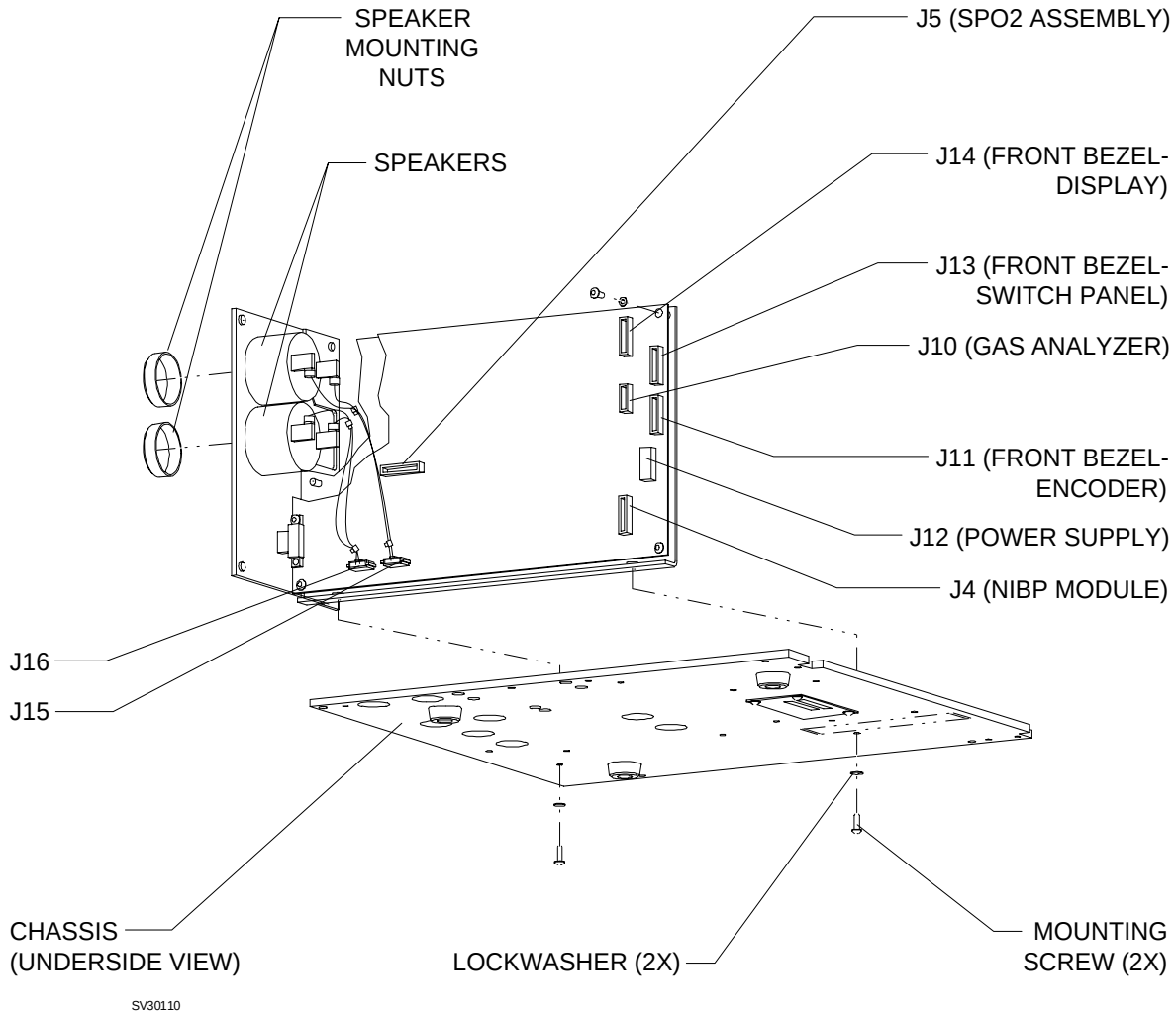


Figure 4-2: REPLACEMENT OF PROCESSOR ASSEMBLY

4.2.12 Restore power to the instrument and observe the power-up diagnostics screen (see Section 2) to verify that the replacement processor board is working properly.

4.2.13 Enter the System Configuration screen (ref. *OPERATOR'S INSTRUCTION MANUAL, VITALERT 3000 SERIES*) and verify that the date and time are set correctly.

4.2.14 Enter the Secondary Service setup screen (see Section 2) and perform the following:

- Reset hours since last serviced
- Make appropriate entry in service log
- Enter Machine serial number
- Enable functions appropriate to unit (NIBP, SpO_2, SEVO, DES)
- Verify correct SW version numbers

NOTE: Restore any default templates documented from original processor. If these parameters were unavailable because of a board fault, attempt to reprogram the standard site template (check another VA3000 or inquire of hospital personnel). If no templates are reprogrammed, advise hospital personnel of this fact.

4.2.15 Perform the PMS Procedure given in Section 6.

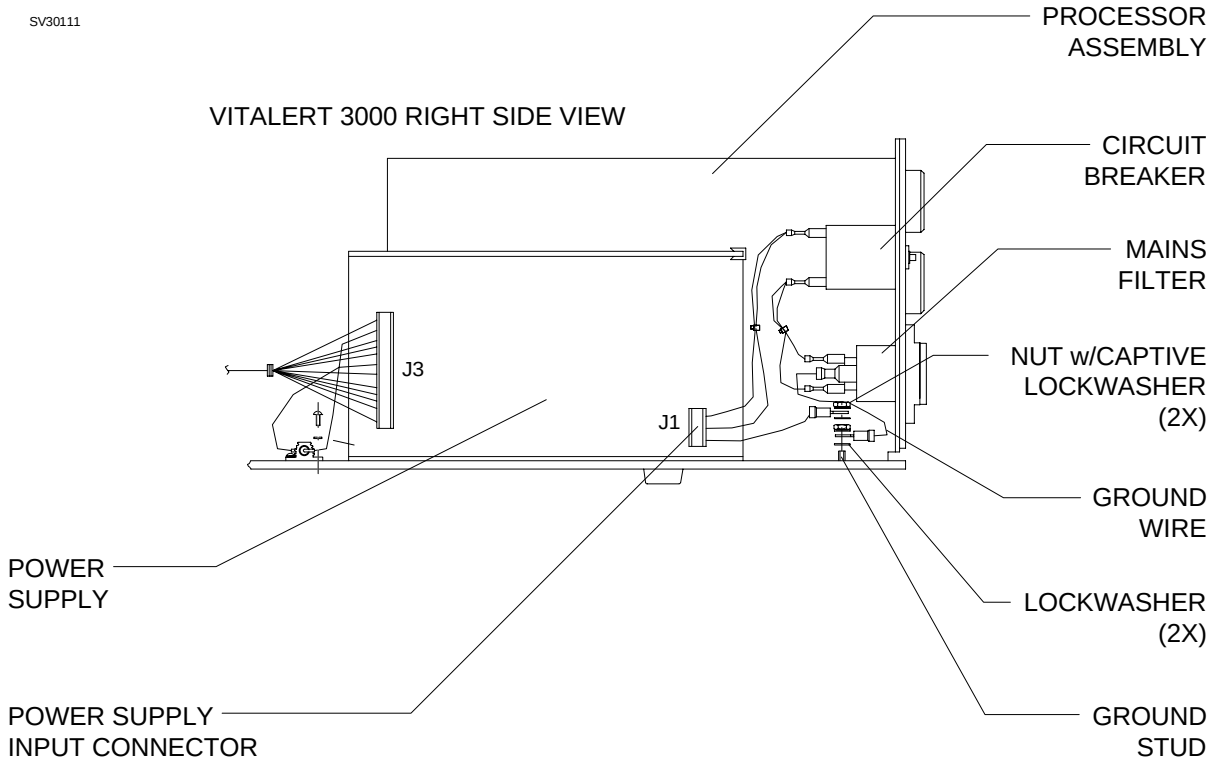


Figure 4-2A: REPLACEMENT OF PROCESSOR ASSEMBLY (continued)

4.3 Power Supply

The power supply is not field serviceable and is replaced as a unit. Figure 4-3 shows the electrical connections and mounting arrangement of the power supply.

4.3.1 Remove the cover as outlined in Procedure 4.1.

4.3.2 Disconnect the input wire harness at J1, and disconnect the output wire harness at J3.

4.3.3 Remove the power supply mounting screws from the underside of the chassis, and carefully lift the power supply fron the chassis.

4.3.4 Transfer the piece of gromet strip to the replacement power supply as shown in the illustration.

4.3.5 Position the replacement power supply in the chassis and secure it with the two screws and lock washers that were previously removed.

4.3.6 Reconnect the output wire harness to J3, and the input wire harness to J1 on the power supply.

4.3.7 Restore AC power to the instrument and verify that the DC voltages are within their allowable range. See Section 3.

4.3.8 Disconnect the AC power cord and reinstall the cover as outlined in Procedure 4.1.

4.3.9 Enter the service screens (see Section 2) and make an appropriate entry in the service log.

4.3.10 Perform the PMS Procedure given in Section 6.

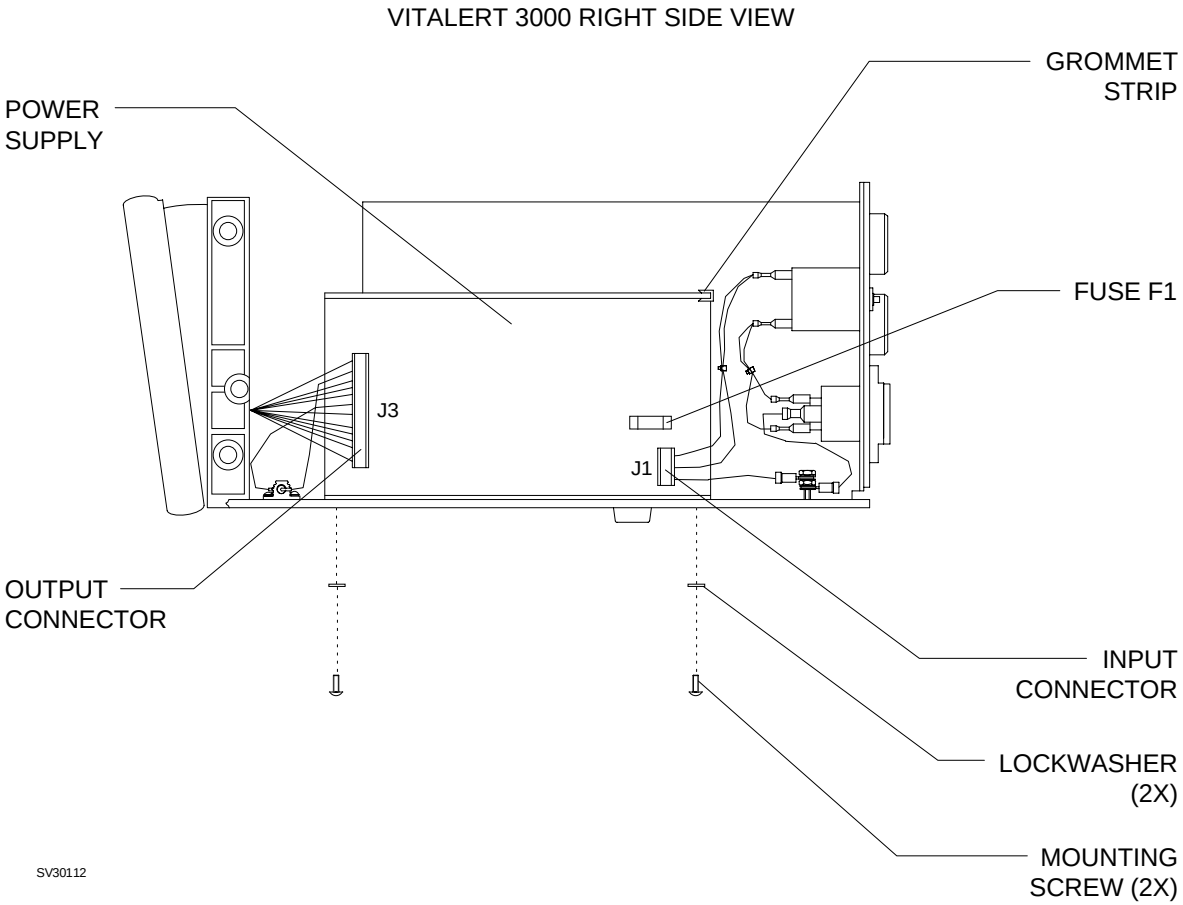


Figure 4-3: REPLACEMENT OF POWER SUPPLY

4.4 Front Bezel Assembly

The front bezel assembly includes the display panel, key switches and rotary encoder. These internal components are not field serviceable, and the bezel is replaced as a complete assembly. Figure 4-4 illustrates the mechanical arrangement of the front bezel and its connections.

CAUTION: The front bezel contains static-sensitive devices. Use ESD protection when handling this assembly.

4.4.1 Remove the cover as outlined in Procedure 4.1.

4.4.2 Disconnect the following from the processor board:

J11 (Wire harness - front panel encoder)
J13 (Ribbon cable - front switch panel)
J14 (Ribbon cable - display)

4.4.3 Disconnect the front bezel ground wire from the ground tab behind the patient interface panel.

4.4.4 Remove the delrin friction disk from the tilt panel friction adjustment mechanism on each side of the bezel. Do not mis-place the panel connecting links.

4.4.5 Position the chassis with its front feet at the edge of a table, so that the bezel overhangs the table.

4.4.6 While holding the front bezel, loosen the two stop plate screws, and slide the stop plate downward.

4.4.7 Carefully swing the bezel assembly downward until its hinge hooks disengage the hinge pins, and lift off the bezel assembly.

4.4.8 Set the replacement bezel assembly hinge hooks onto the hinge pins, and swing the bezel up into its normal position.

4.4.9 Raise the stop plate into position and tighten its screws.

4.4.10 Re-assemble the tilt panel friction adjustment mechanism on each side of the bezel, with the friction disks correctly engaged in the panel connecting links. Tighten the friction adjustment screws until the tilt action has the desired tension.

4.4.11 Connect the front bezel ground wire to the ground tab, and connect the front bezel cables and wire harness to J14, J13 and J11 on the processor board.

4.4.12 Reinstall the cover as outlined in Procedure 4.1.

4.4.13 Enter the service screens (see Section 2) and make an appropriate entry in the service log.

4.4.14 Perform the PMS Procedure given in Section 6.

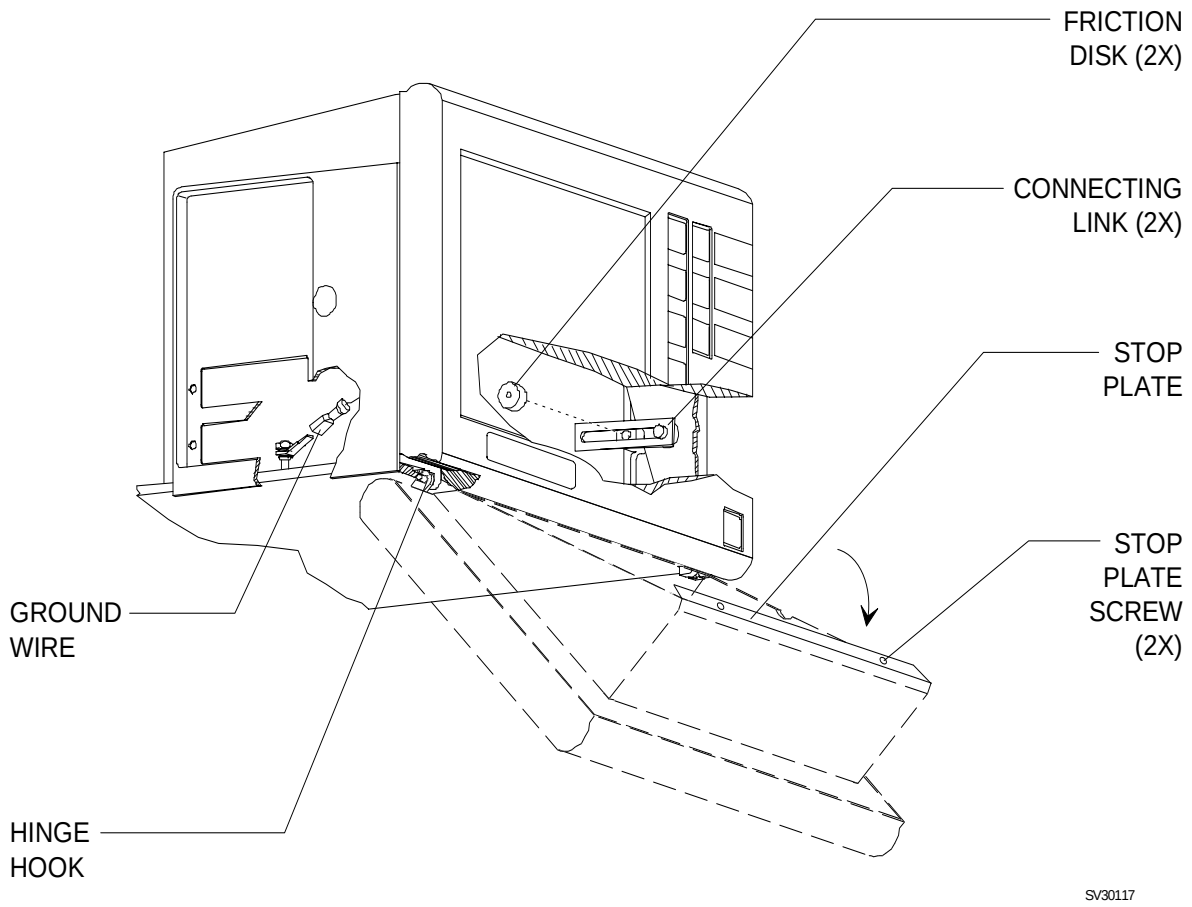


Figure 4-4: REPLACEMENT OF FRONT BEZEL ASSEMBLY

4.5 SpO_2 Assembly

The SpO_2 assembly comprises a plexiglass bracket that holds the isolation PCB, the SpO_2 module and their interconnecting cable. Figure 4-5 shows the mounting arrangement and connections to the assembly.

CAUTION: The SpO_2 assembly contains static-sensitive devices. Use ESD protection when handling this assembly.

4.5.1 Remove the cover as outlined in Procedure 4.1.

4.5.2 Disconnect the ribbon cable from J5 on the processor board.

4.5.3 Disconnect the ribbon cable from J13 on the gas analyzer PCB (for better access to the SpO_2 assembly).

4.5.4 Remove the two SpO_2 assembly mounting screws from the underside of the chassis. Carefully lift the assembly and set it to the left of the chassis.

4.5.5 Cut the tie strap holding the cable from the interface panel, and disconnect the cable from the SpO_2 module.

4.5.6 Connect the interface cable to the replacement SpO_2 assembly and install a new tie strap in the same manner as original.

4.5.7 From the old SpO_2 assembly, transfer the ribbon cable to J1 on the isolation PCB of the replacement assembly.

4.5.8 Carefully position the replacement SpO_2 assembly in the chassis and secure the assembly with the screws and lock washers that were previously removed.

4.5.9 Reconnect the ribbon cable to J13 on the gas analyzer PCB that was previously disconnected.

4.5.10 Reconnect the ribbon cable from the SpO_2 assembly to processor board J5.

4.5.11 Reinstall the cover as outlined in Procedure 4.1.

4.5.12 Enter the service screens (see Section 2) and make an appropriate entry in the service log. Run the SpO_2 diagnostics and verify that the replacement assembly is working properly.

4.5.13 Perform the PMS Procedure given in Section 6.

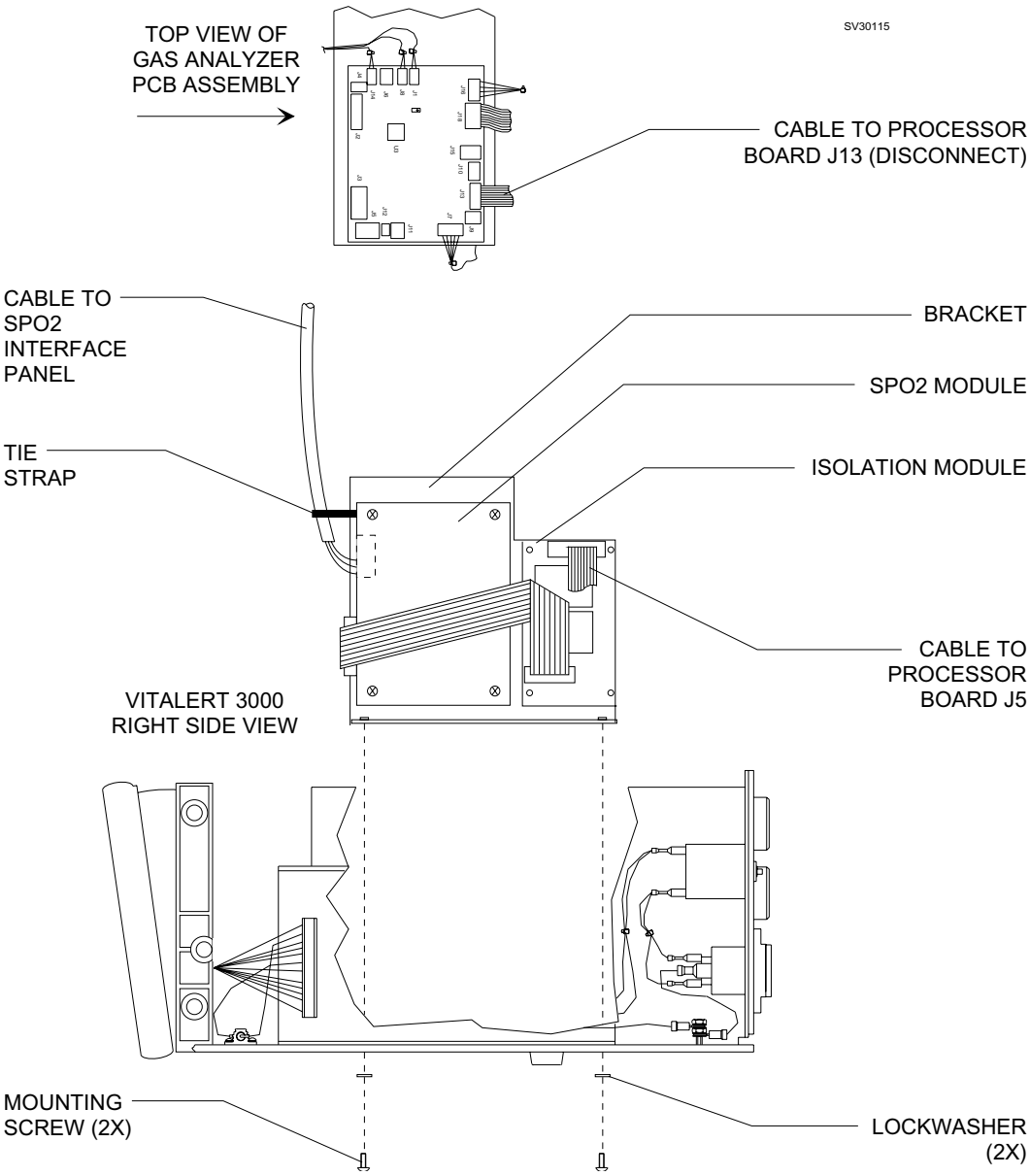


Figure 4-5: REPLACEMENT OF THE SpO_2 ASSEMBLY

4.6 NIBP Module

The NIBP module containing the pump and circuitry is mounted on a bracket that must first be removed from the chassis in order to replace the module. Figure 4-6 shows the tubing and electrical connections, and the mounting arrangement.

CAUTION: The NIBP assembly contains static-sensitive devices. Use ESD protection when handling this assembly.

4.6.1 Remove the cover as outlined in Procedure 4.1.

4.6.2 Tilt the front bezel out to its stop.

4.6.3 Disconnect the hose from the top of the NIBP module.

4.6.4 Disconnect the ribbon cable from J4 on the processor board.

4.6.5 Disconnect the power wire harness from J7 on the gas analyzer PCB (for better access to the NIBP assembly).

4.6.6 Remove the NIBP bracket mounting screws from the underside of the chassis, and carefully lift the assembly from the chassis.

4.6.7 Remove the four screws holding the NIBP module to the bracket, and remove the module.

4.6.8 Install the replacement NIBP module on the bracket with the screws and lock washers that were previously removed.

4.6.9 Transfer the ribbon cable to the replacement NIBP module. Be sure that cable is routed in the same manner as original so as not to pinch the cable under the bracket during installation.

4.6.10 Position the assembly in the chassis, and secure the bracket to the chassis with the four screws and lockwashers that were previously removed.

4.6.11 Reconnect the ribbon cable to J4 on the processor board.

4.6.12 reconnect the power wire harness that was previously disconnected from J7 on the gas analyzer PCB.

4.6.13 Reconnect the hose to the hose barb on the replacement NIBP module. Be sure that the hose clamp is installed properly.

4.6.14 Reinstall the cover as outlined in Procedure 4.1.

4.6.15 Enter the service screens (see Section 2) and make an appropriate entry in the service log. Run the NIBP diagnostics and verify that the replacement assembly is working properly.

4.6.16 Perform the PMS Procedure given in Section 6.

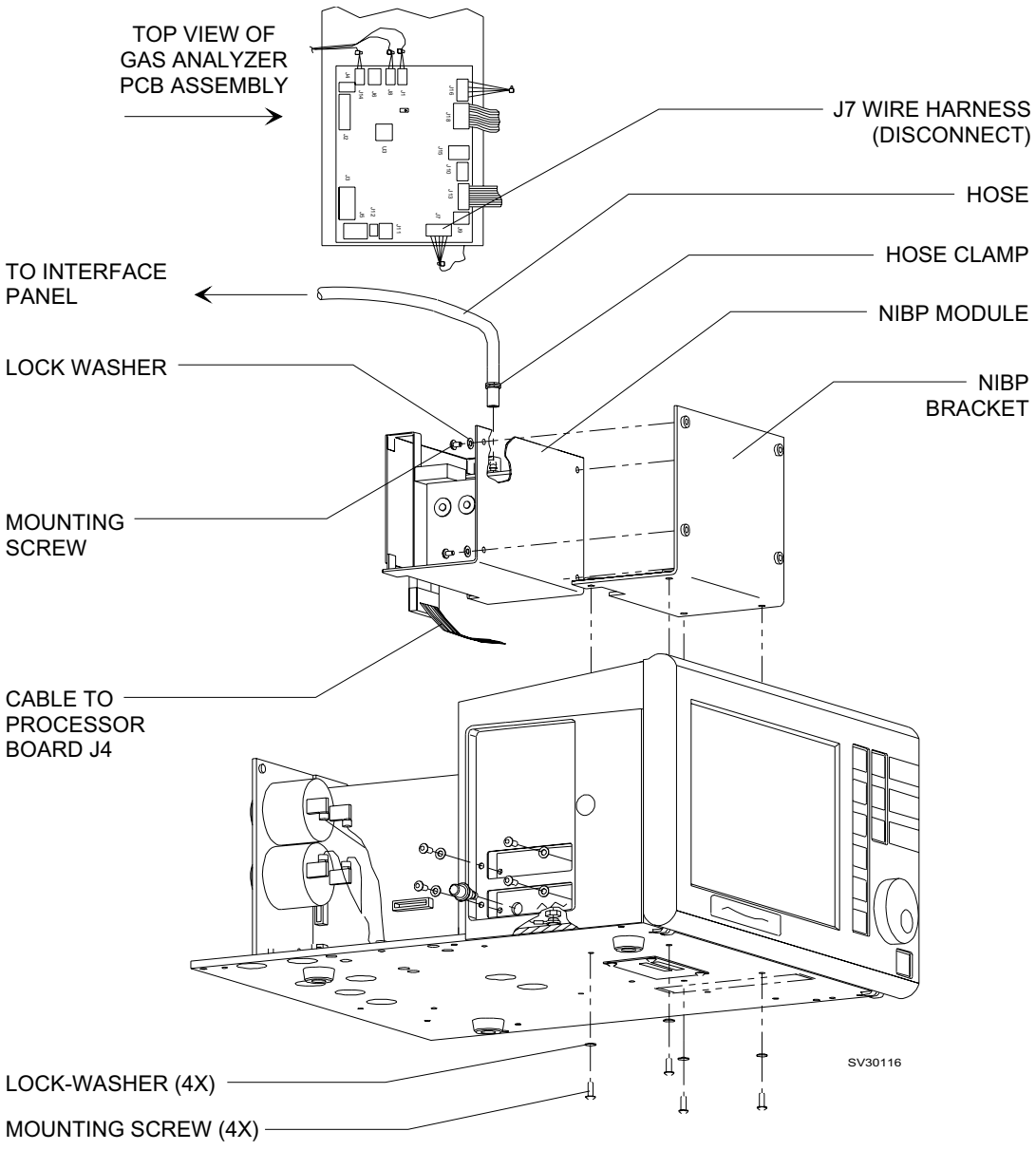


Figure 4-6: REPLACEMENT OF THE NIBP ASSEMBLY

4.7 Gas Analyzer Assembly

The gas analyzer is replaced as a complete assembly; none of its components are field serviceable with the exception of the pump, which is covered by a separate replacement procedure. Figure 4-7 illustrates the gas analyzer mounting arrangement and its electrical connections.

CAUTION: The gas analyzer assembly contains static-sensitive devices. Use ESD protection when handling this assembly.

4.7.1 Remove the cover as outlined in Procedure 4.1.

4.7.2 Disconnect the power wire harness from J7 on the gas analyzer PCB.

4.7.3 Disconnect the processor board cable from J13 on the gas analyzer PCB.

4.7.4 If applicable, cut the tie strap securing the SpO_2 interface panel cable to the left front spacer on the gas analyzer assembly.

4.7.5 Remove the four gas analyzer assembly mounting screws from the underside of the chassis, and carefully lift the assembly from the chassis.

4.7.6 Position the replacement assembly in the chassis, and secure it with the four screws and lock washers that were previously removed.

4.7.7 Reconnect the processor board cable to J13, and the power wire harness to J7 on the gas analyzer PCB.

4.7.8 If applicable, install a new tie strap to retain the SpO_2 interface panel cable in the same manner as original.

4.7.9 Reinstall the cover as outlined in Procedure 4.1.

4.7.10 Enter the service screens (see Section 2) and make an appropriate entry in the service log. Set the sample flow rates and perform an accuracy check (see Section 5) and a span calibration if needed.

4.7.11 Perform the PMS Procedure given in Section 6.

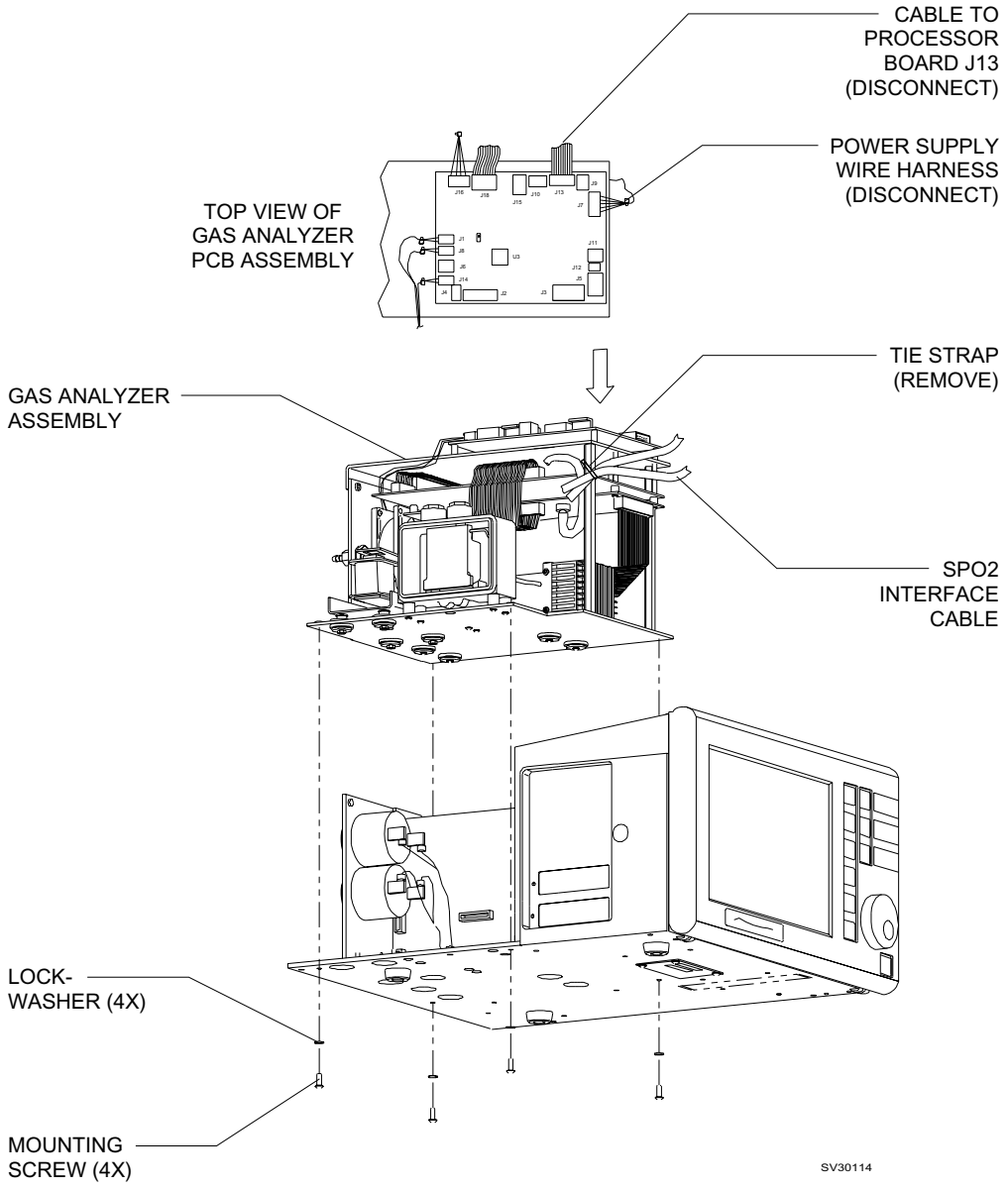


Figure 4-7: REPLACEMENT OF THE GAS ANALYZER ASSEMBLY

4.8 Sample Pump

The sample pump on the gas analyzer assembly is field replaceable and can be replaced without removing the gas analyzer from the chassis. Figure 4-8 shows the pump mounting arrangement and its pneumatic and electrical connections.

CAUTION: The gas analyzer assembly contains static-sensitive devices. Use ESD protection when handling this assembly.

4.8.1 Remove the cover as outlined in Procedure 4.1.

4.8.2 Disconnect the pump wire harness from J1 on the gas analyzer PCB.

4.8.3 Cut the tie straps joining the pump, fan and solenoid wire harnesses.

4.8.4 Remove the four pump mounting screws, nuts and washers securing the pump to the gas anslyzer.

4.8.5 Pull the pump out far enough to gain access to its hose connections.

4.8.6 Disconnect the intake and exhaust hoses from tht pump, and remove the pump from the analyzer.

4.8.7 Connect the intake and exhaust hoses to the replacement pump, and ensure that the hose clamps are installed properly.

4.8.8 Position the replacement pump in the analyzer assembly and secure it with the hardware that was previously removed.

4.8.9 Connect the pump wire harness to J1 on the gas analyzer PCB.

4.8.10 Join the pump, fan and solenoid wire harnesses with new tie straps in the same manner as original.

4.8.11 Reinstall the cover as outlined in Procedure 4.1.

4.8.12 Enter the service screens (see Section 2) and make an appropriate entry in the service log. Set the sample flow rates as outlined in Section 5.

4.8.13 Perform the PMS Procedure given in Section 6.

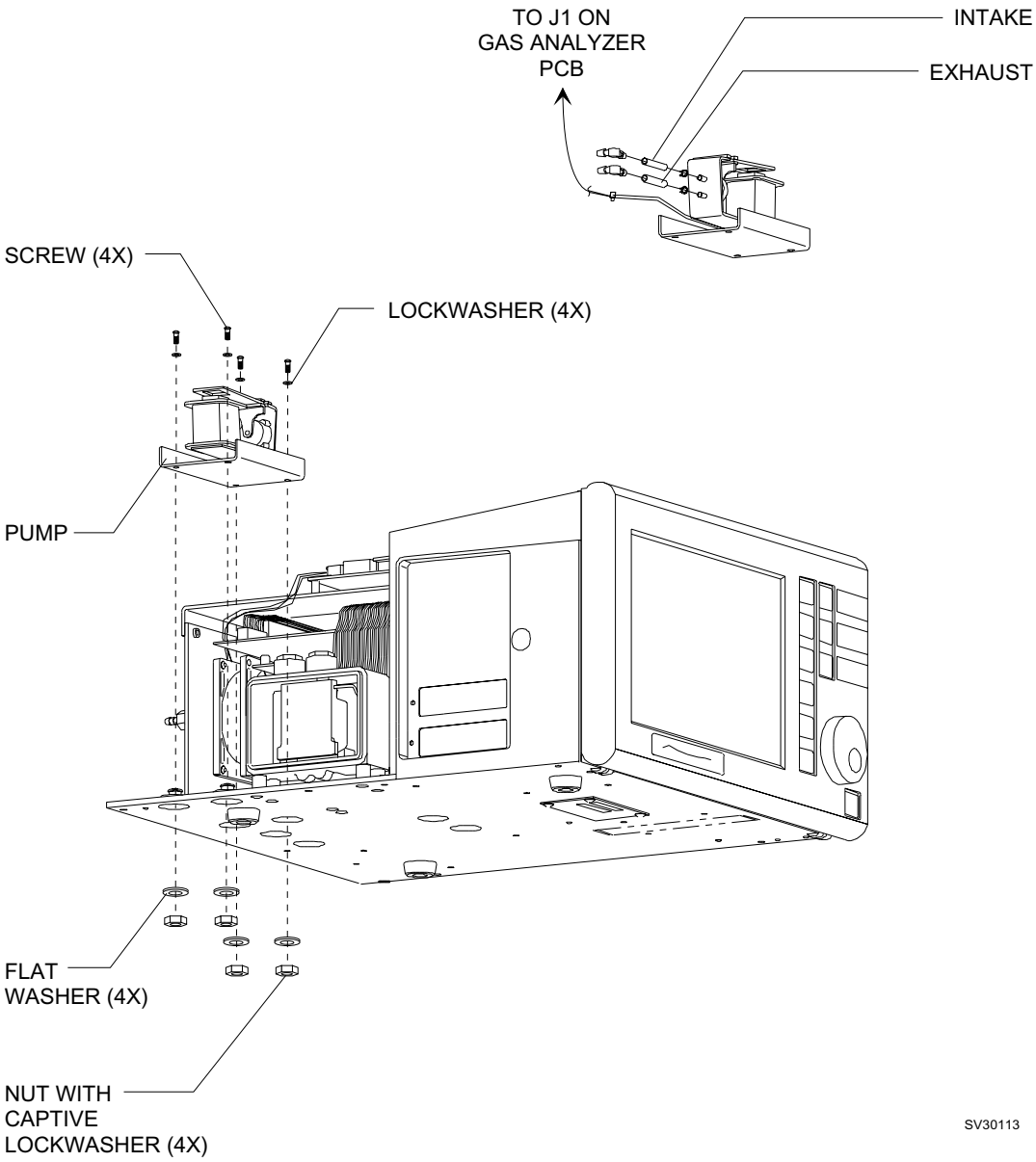


Figure 4-8: REPLACEMENT OF THE SAMPLE PUMP

4.9 Firmware

The four firmware I.C.s are located toward the rear of the processor board as shown in Figure 4-9. Be sure to observe all handling precautions and verify that each replacement I.C. is in its correct location.

CAUTION: The processor board contains static-sensitive devices. Use ESD protection when handling this assembly.

4.9.1 Remove the cover as outlined in Procedure 4.1.

4.9.2 Remove the processor assembly as outlined in Procedure 4.2.

4.9.3 Remove the four firmware I.C.s, U21 thru U24.

4.9.4 Install the replacement firmware I.C.s as follows:

U21: P/N 4111711-001
U22: P/N 4111711-003
U23: P/N 4111711-004
U24: P/N 4111711-002

Be sure that each I.C. is installed in its correct location and that its index is oriented correctly.

4.9.5 Reinstall the processor assembly as outlined in Procedure 4.2.

4.9.6 Reinstall the cover as outlined in Procedure 4.1.

4.9.7 Restore power to the instrument and observe the power-up diagnostics screen (see Section 2) to verify that the replacement processor board is working properly.

4.9.8 Enter the service screens (see Section 2) and perform the following:

- Reset date and time
- Make appropriate entry in service log
- Enter Machine serial number
- Verify correct SW version numbers

4.9.9 Perform the PMS Procedure given in Section 6.

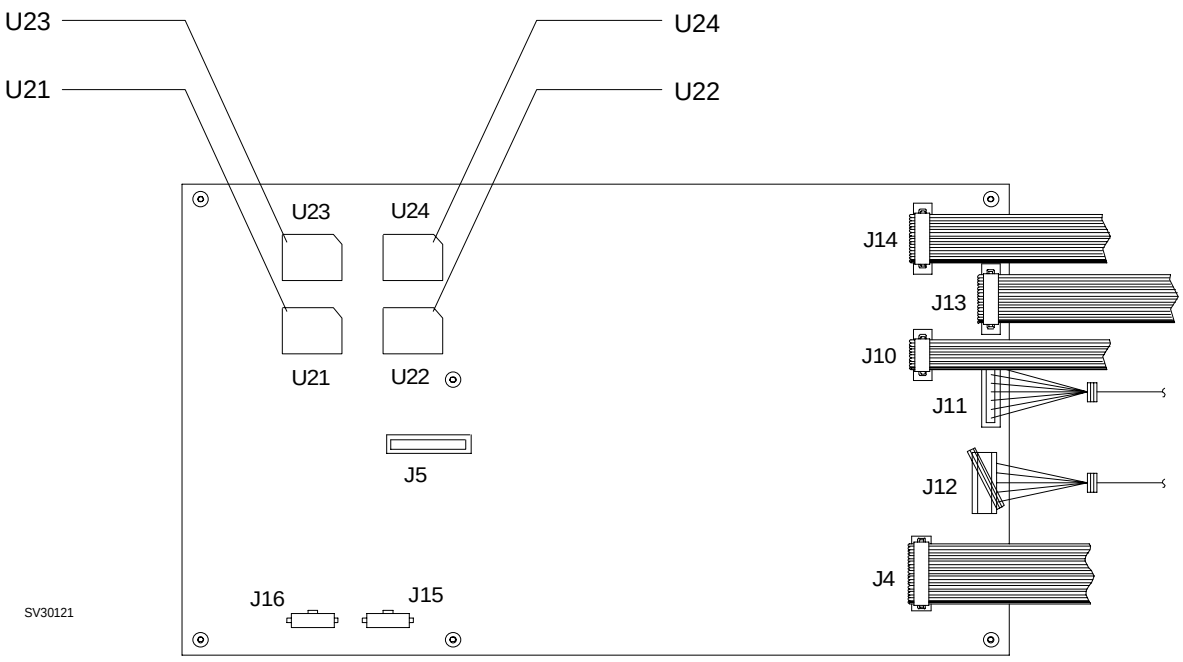


Figure 4-9: PROCESSOR BOARD FIRMWARE LOCATIONS

5.0 ADJUSTMENT AND CALIBRATION PROCEDURES

Equipment Required:

-- Calibration Gas Adapter, NAD Part No. 4110716 (agent cal)
-- Calibration Gas Cylinder, NAD Part No. 4110599 or 4110599-001

-- Calibration Gas Adapter, NAD Part No. 4110216 (CO_2 check)
-- Calibration Gas Cylinder, NAD Part No. 4107979 or 4107979-001

-- Certified sample gas cylinder for gas analyzer accuracy check

-- Flowmeter Test Stand, NAD Part No. S000081

-- Nellcor® model PT-2500 Pocket Tester for SpO_2 calibration check

-- Test fixture with Luer fittings, TEE connector, and pressure gauge, for NIBP inflation pressure test

5.1 SpO_2 Monitor Calibration Check

5.1.1 Place the instrument in the STANDBY mode (power off).

5.1.2 Disconnect the SpO_2 sensor cable from the Nellcor® module, and plug the Nellcor model PT-2500 Pocket Tester into the module as shown in Figure 5-1.

5.1.3 Press the ON/STANDBY key (power on).

5.1.4 Enter the main service screen by simultaneously pressing and holding the MONITOR and SYSTEM CONFIG keys, and pressing the dial.

NOTE: While still in the Main Service Screen, note the "OXIM SW VERSION" number. It should be of the form "V x.x.x" or "Vx.x.x.x". The former indicates that a Nellcor MP-202 is installed. The latter indicates a MP-203.

5.1.5 Set the cursor to MONITORS and press the dial.

5.1.6 Set the cursor to SPO2 and press the dial.

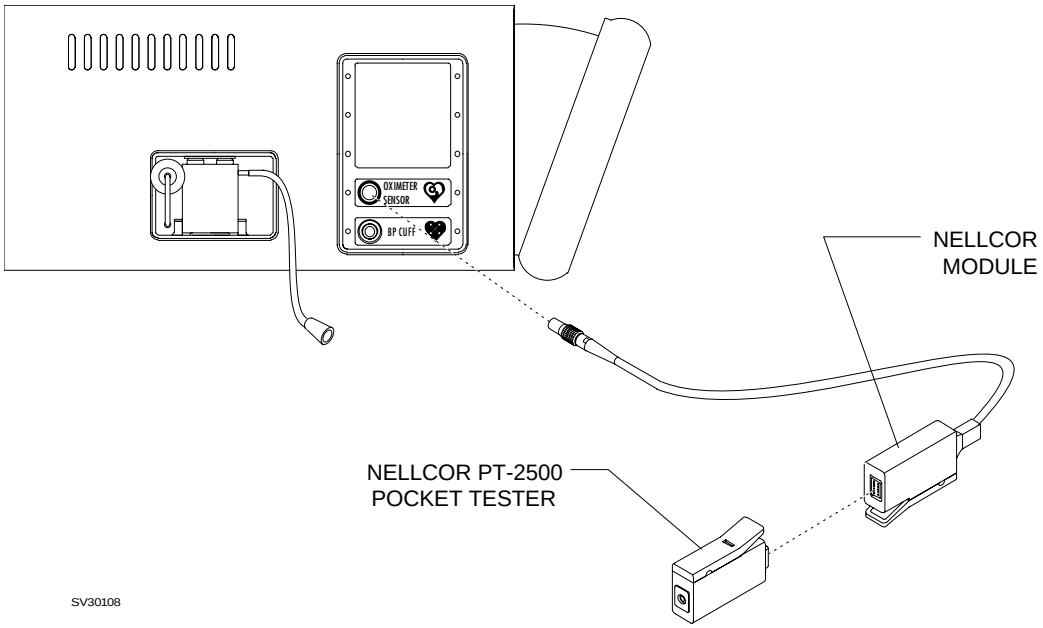
5.1.7 The red indicator lamp on the PT-2500 should be lighted, indicating that the tester is working properly.

5.1.8 The screen should display an SpO_2 value of 81 ± 1, and a Pulse value of 61 ± 1 if the VA3000 is equipped with a Nellcor MP-202 pulse oximeter module.

If the VA3000 is equipped with a Nellcor MP-203 pulse oximeter, the Pulse value displayed should be 40 ± 1.

5.1.9 Press the ON/STANDBY key (power off).

5.1.10 Disconnect the PT-2500 from the Nellcor module, and connect the SpO_2 sensor cable to the module.



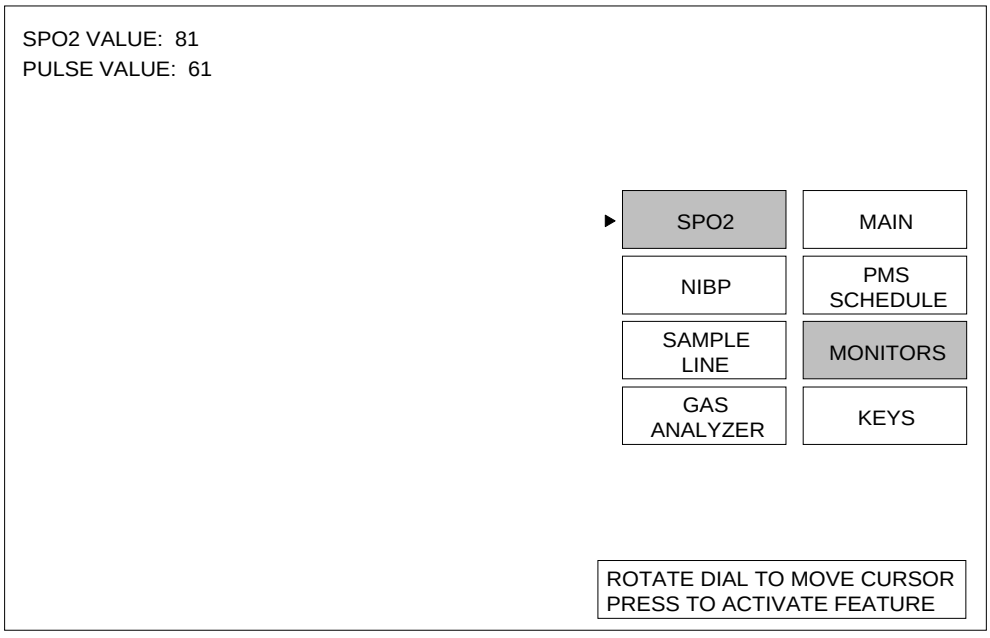


Figure 5-1: SpO_2 TEST SETUP AND SCREEN

5.2 NIBP Cuff Inflation Pressure Check

5.2.1 Place the instrument in the STANDBY mode (power off).

5.2.2 Disconnect the BP cuff tubing at the interface panel, and insert a test fixture TEE assembly with an external pressure gauge as shown in Figure 5-2.

5.2.3 Wrap the cuff loosely around a cylindrical object and fasten its closure.

5.2.4 Press the ON/STANDBY key (power on).

5.2.5 Enter the main service screen by simultaneously pressing and holding the MONITOR and SYSTEM CONFIG keys, and pressing the dial.

5.2.6 Set the cursor to MONITORS and press the dial.

5.2.7 Set the cursor to NIBP and press the dial.

5.2.8 Set the cursor to TEST and press the dial to begin cuff inflation.

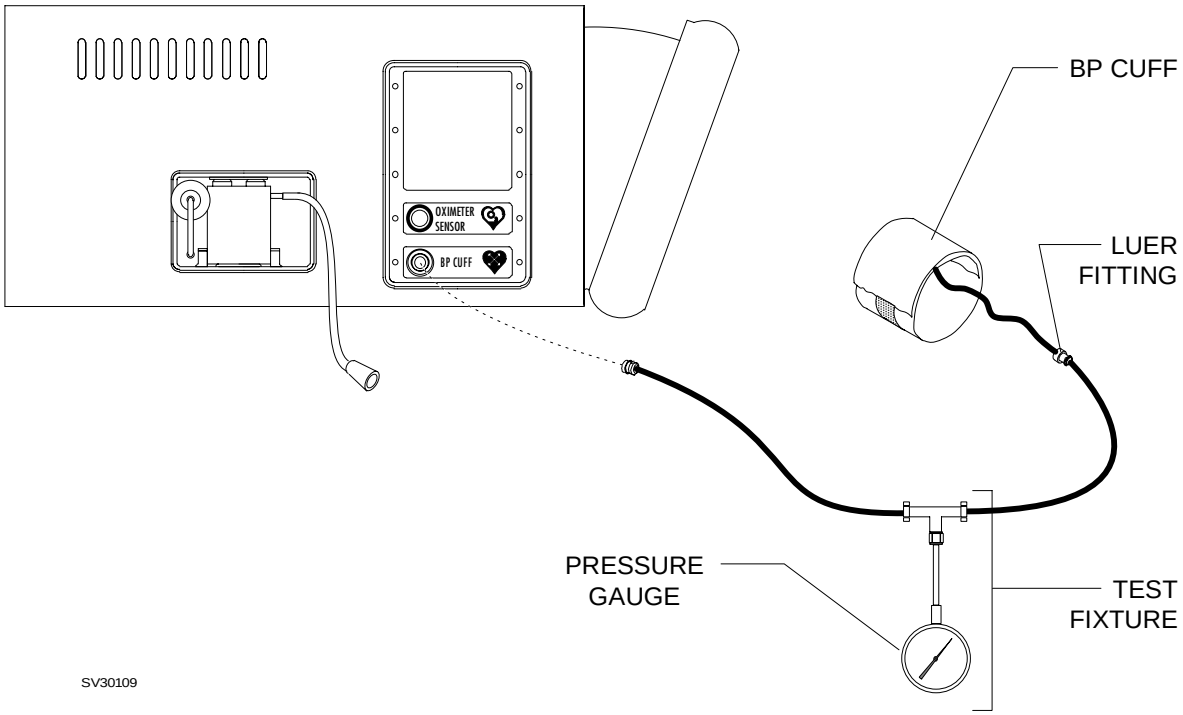
5.2.9 Wait one minute, then compare the gauge pressure to the displayed CUFF PRESSURE VALUE. The readings should agree within ± 5 mm Hg. The pressure reading shall drop no more than 5 mm Hg from this value in the next three minutes.

NOTE: With software version 1.05 the sensitivity of the automatic test may be too high. If a "FAIL" message appears on the Status line, it should be disregarded if the above pressure test does not indicate a leak.

NOTE: If this test indicates a leak, replace the cuff and cuff extension hose, and repeat the test.

5.2.10 Press the ON/STANDBY key (power off).

5.2.11 Disconnect the test fixture and reconnect the BP cuff to the interface panel.



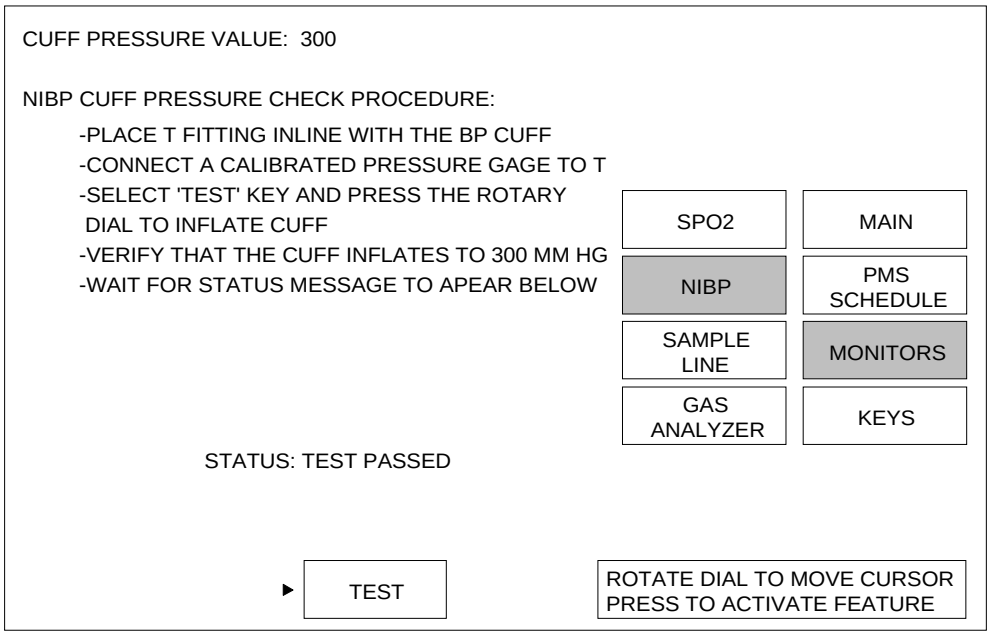


Figure 5-2: NIBP CUFF INFLATION PRESSURE TEST AND SCREEN

5.3 Gas Sample Line Flow Calibration

5.3.1 Ensure that the disposable reservoir and the sample line are clear of any fluid or obstructions. Replace them if necessary. A 96-inch sample line (NAD P/N 4108103) must be attached when performing the sample line calibration.

5.3.2 Connect a test flow meter to the exhaust port on the rear panel of the instrument.

5.3.3 Enter the main service screen by simultaneously pressing and holding the MONITOR and SYSTEM CONFIG keys, and pressing the dial.

5.3.3.A Set the cursor to MONITORS and press the dial.

5.3.4 Set the cursor to SAMPLE LINE and press the dial. Ref. Figure 5-3A.

MAXIMUM FLOW ADJUSTMENT:

NOTE: The Maximum Flow Adjustment must be set before performing the flow calibrations.

5.3.5 Set the cursor to ADJUST FLOW and press the dial.

5.3.6 Rotate the dial until the test flow meter reaches a maximum flow "plateau".

5.3.7 Adjust the variable flow restrictor (see Figure 5-3) until the test flow meter indicates 220 ml/min. Turn the adjusting screw clockwise to decrease flow; counter-clockwise to increase flow.

5.3.8 Press the dial.

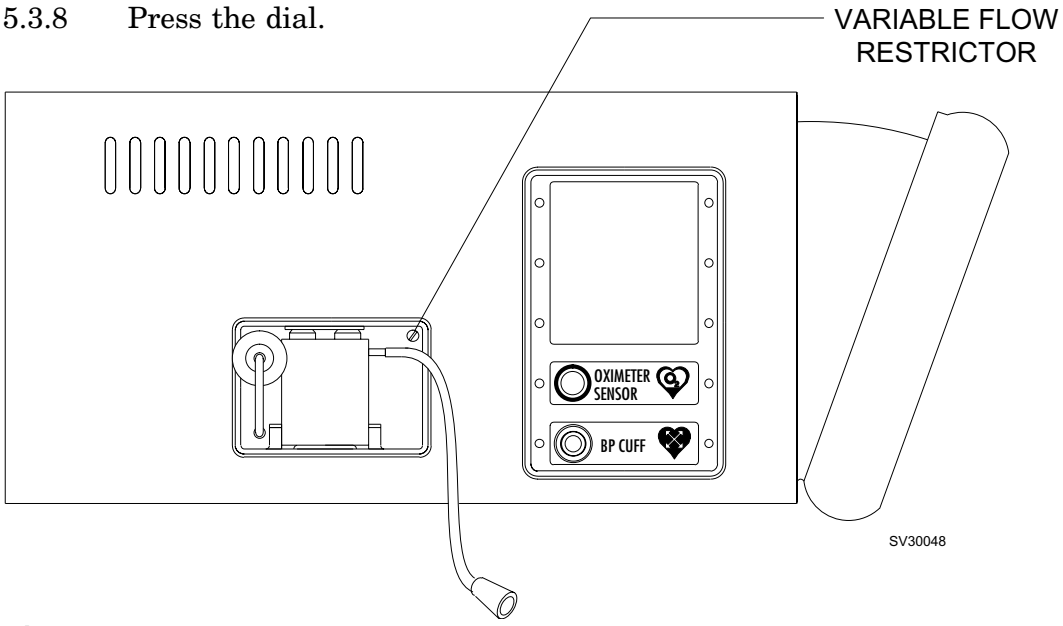


Figure 5-3: MAXIMUM FLOW ADJUSTMENT LOCATION

LOW FLOW CALIBRATION:

5.3.9 Set the cursor to ADJUST FLOW and press the dial.

5.3.10 Rotate the dial until the flow meter indicates 100 ml/min, and press the dial.

5.3.11 Set the cursor to STORE LOW and block the sample line for five seconds.

5.3.12 Press the dial. Keep the sample line blocked until STORE LOW is no longer lighted.

HIGH FLOW CALIBRATION:

5.3.13 Set the cursor to ADJUST FLOW and press the dial.

5.3.14 Rotate the dial clockwise until the flow rate is below 200 ml/min., then slowly turn the dial clockwise until the flow meter just indicates 200 ml/min. (do not turn the dial further), and press the dial.

5.3.15 Set the cursor to STORE HIGH and block the sample line for five seconds.

5.3.16 Press the dial. Keep the sample line blocked until STORE HIGH is no longer lighted.

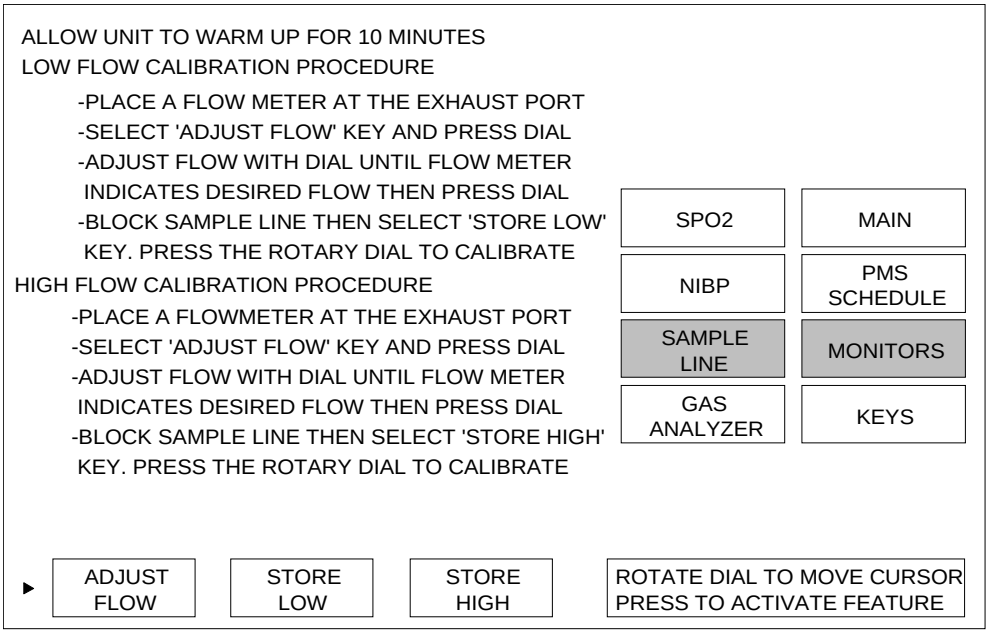


Figure 5-3A: SAMPLE LINE FLOW SERVICE SCREEN

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CALIBRATION VERIFICATION:

5.3.17 Press the ON/STANDBY key to turn off the monitor.

5.3.18 Press the ON/STANDBY key a second time to restart the monitor.

5.3.19 At the completion of the self-test, press the MONITOR SETUP key on the main key panel.

5.3.20 Set the cursor to SAMP FLOW, and press the dial to highlight the flow rate bar graph.

5.3.21 Rotate the dial until the flow rate is at its lowest setting (bar graph completely empty). The flow meter should read 100 ml/min. ± 25.

5.3.22 Rotate the dial until the flow rate is at its highest setting (bar graph completely filled). The flow meter should read 200 ml/min. ± 25.

5.3.23 Press the MONITOR key on the main key panel.

5.3.24 Occlude the sample line. A Line Block advisory message should appear within 15 seconds. If the advisory does not appear, repeat the calibration procedures or contact DrägerService.

5.3.25 Release sample line occlusion. The Line Block advisory should disappear within 5 seconds.

5.4 Gas Analyzer Span Calibration

NOTE: Before performing a Span calibration, perform the following accuracy test to determine whether a Span calibration is needed.

NOTE: Before performing an accuracy test or Span calibration, ensure that the CO2 UNITS is set to %. Refer to the *Monitor Setup Screen* in the *Operator's Instruction Manual*.

ACCURACY TEST:

5.4.1 Press the MONITOR SETUP key on the main key panel.

5.4.2 Set the cursor to CO2/AGT selection on the display. A box appears around the CAL selection.

5.4.3 Press the dial to begin a zero calibration. A message appears in the CO_2 area to indicate that a calibration is in progress. When the calibration is complete, the box around the word CAL disappears.

5.4.4 When the calibration is complete, press the MONITOR key on the main control panel to return to the Monitor Screen.

5.4.5 Attach the CO_2 cylinder adapter (NAD P/N 4110216) to the CO_2 verification gas cylinder (NAD P/N 4107979 or 4107979-001).

5.4.6 Slightly open the flow control valve on the CO_2 cylinder adapter by turning it counterclockwise.

5.4.7 Wait for one full screen waveform sweep, then close the cylinder valve and remove the sample line from the adapter.

5.4.8 Verify that the CO_2 display indicates a value between 4.8% and 5.2%. If the reading is not within the specified range, the following Span calibration procedure must be performed.

SPAN CALIBRATION PROCEDURE:

5.4.9 Return to the Main Service Screen by simultaneously pressing and holding the MONITOR and SYSTEM CONFIG keys, and pressing the rotary dial.

5.4.10 Set the cursor to MONITORS and press the dial.

5.4.11 Set the cursor to GAS ANALYZER and press the dial.

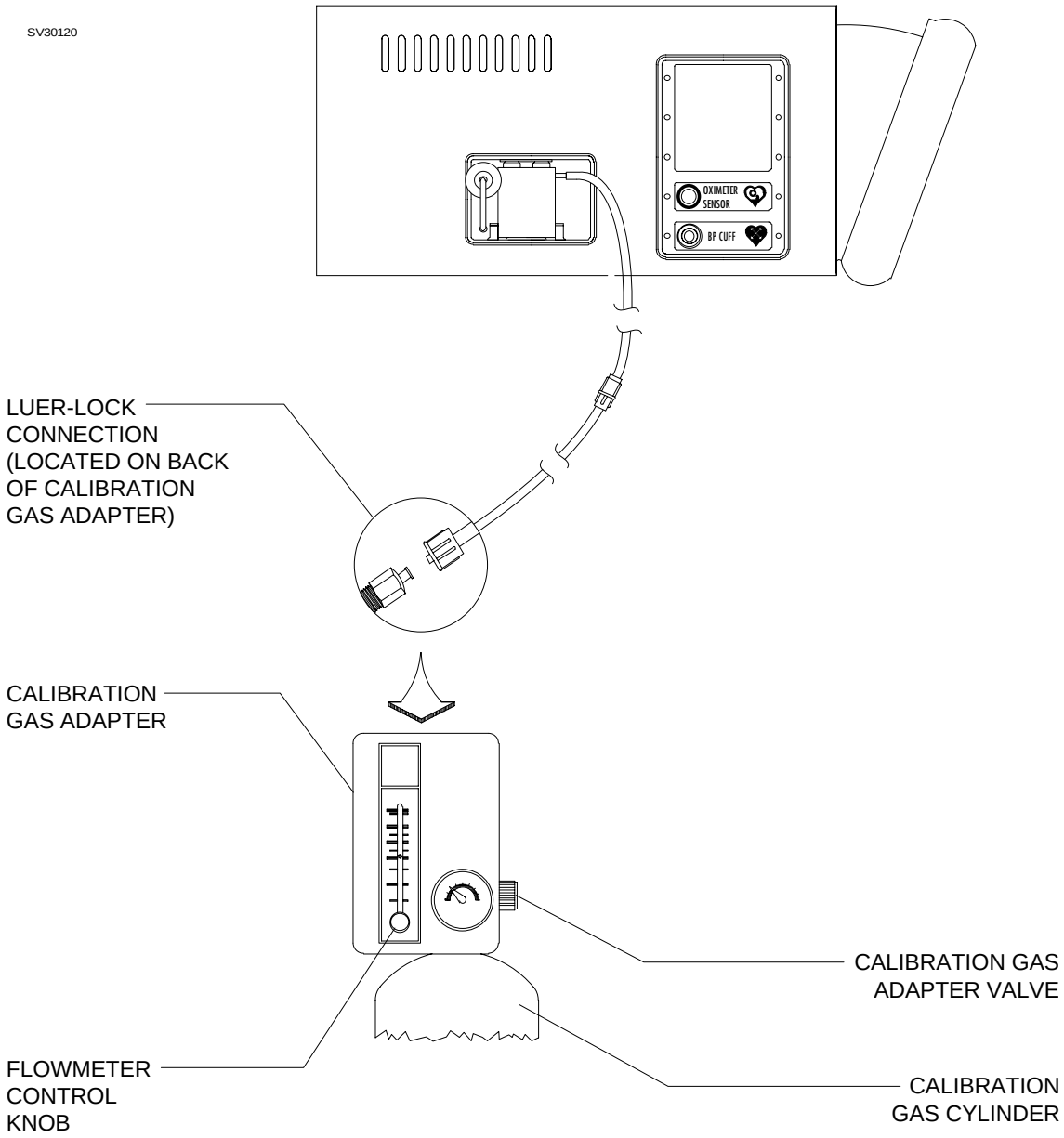

Figure 5-4: GAS ANALYZER CALIBRATION SETUP

NOTE: The monitor should enter full accuracy mode within 8 minutes after power-on, as indicated by a MODE: READY message. See Figure 5-5.

5.4.12 Attach a calibration adapter (NAD P/N 4110716) to the calibration gas cylinder (NAD P/N 4110599 or 4110599-001) as shown in Figure 5-4.

5.4.13 Connect the the gas sample line to the Luer fitting on the calibration gas adapter.

5.4.14 Set the flow from the calibration gas adapter equal to the previously measured exhaust flow.

5.4.15 Set the cursor to SPAN and press the dial.

An automatic Zero calibration will be performed, followed by a STATUS: ZERO PASS message. The automatic Span calibration will then be performed, followed by a STATUS: SPAN PASS message. During the calibration procedure a MODE: NOT READY message will be displayed.

5.4.16 Press the ON/STANDBY key to turn off the monitor.

5.4.17 Press the ON/STANDBY key a second time to restart the monitor.

5.4.18 Perform the Gas Analyzer Accuracy Test, outlined earlier in this section, to verify acceptance of the Span calibration.

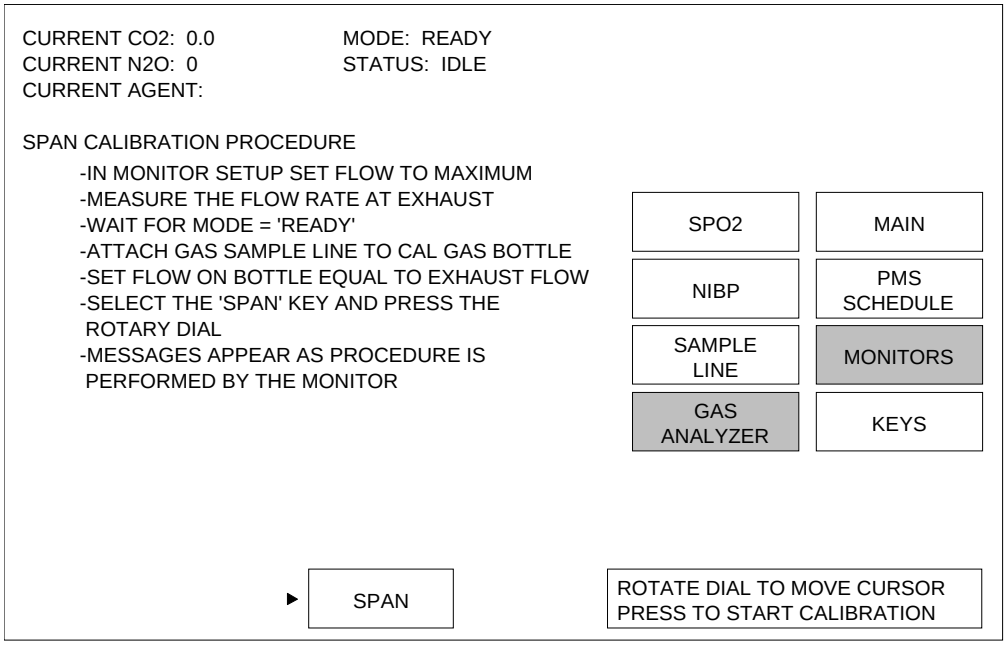

Figure 5-5: GAS ANALYZER SERVICE SCREEN

5.5 Tilt Bezel Friction Adjustment

5.5.1 Turn the friction adjustment hex head socket screws, located on both sides of the bezel, using a 1/8" hex wrench. Refer to Figure 5-6. Clockwise rotation tightens the bezel; counter-clockwise rotation loosens the bezel.

5.5.2 Check the feel of the bezel and readjust the screws if necessary. Make adjustments in small increments to avoid over-tightening and damaging the bezel. The bezel should operate smoothly and without binding.

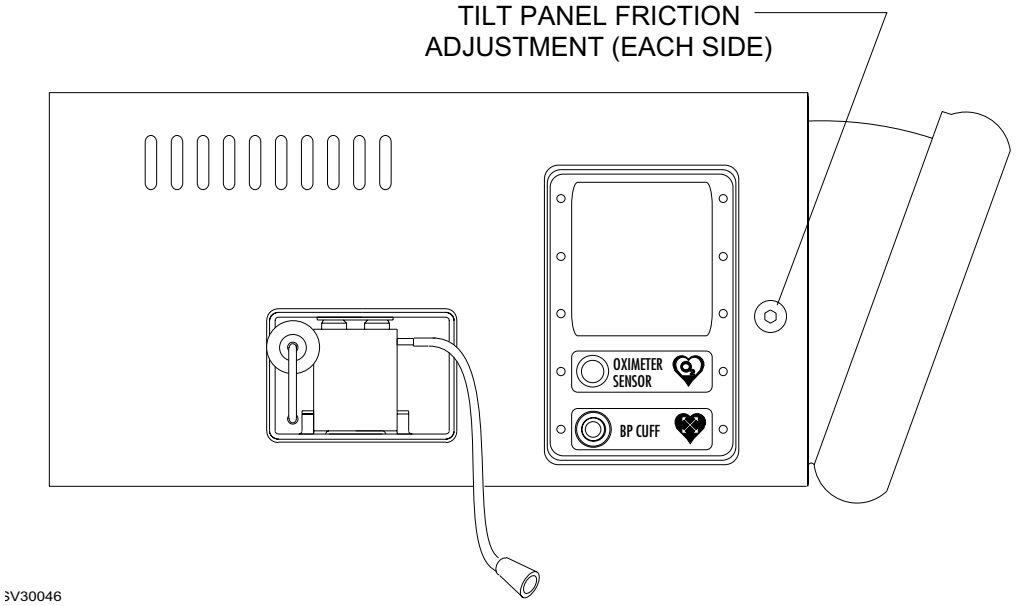

Figure 5-6: LOCATION OF TILT PANEL ADJUSTMENTS

RETURN TO THIS MANUAL'S TABLE OF CONTENTS
RETURN TO CD-ROM TABLE OF CONTENTS

6.0 PMS PROCEDURE

The procedures in this section shall be performed in their entirety each time a component is removed, replaced, calibrated or adjusted, and during all scheduled Periodic Manufacturer's Service (PMS) visits. A PMS Checklist form shall be completed by the Technical Service Representative each time a PMS is performed. The section numbers on the PMS Checklist form are keyed to paragraph numbers in this service manual. These forms are available from the DrägerService.

NOTE: Verify the dates on test equipment calibration labels. DO NOT USE any test equipment having an expired calibration date. Notify your supervisor immediately if any equipment is found to be out of calibration.

Record the test equipment used and its identification in the space provided at the bottom of the PMS Checklist form.

6.1 Safety and Electrical Testing

6.1.1 Circuit Isolation Test

6.1.1.1 Verify that the VA3000 is in the Standby mode, remove all cables and disconnect the power cord.

6.1.1.2 Disable the circuit breaker on the back panel.

6.1.1.3 Remove the VA3000 cover.

6.1.1.4 Set a multimeter to its highest resistance range; check for continuity between the VA3000 chassis and Pin 4 of J7 on the gas analyzer interface PCB (upper PCB on gas analyzer assembly). There shall be no continuity between these points.

6.1.1.5 Disconnect the multimeter and reinstall the VA3000 cover.

6.1.1.6 Enable the circuit breaker and reinstall the AC power cord.

6.1.2 Chassis Resistance Test

NOTE: Do not plug the safety analyzer power cord into a line isolation monitor, as inaccurate readings may occur.

6.1.2.1 Plug the safety analyzer power cord into a live AC receptacle and set the power switch of the analyzer to the ON position.

6.1.2.2 Insert the double red lead set into the two red inputs marked "SINGLE LEADS" on the analyzer, and attach the red lead set alligator clip to the metal "exhaust" barb on the rear of the VA3000.

6.1.2.3 Set the safety analyzer Polarity switch to the OFF position, and the GROUND and NEUTRAL switches to NORMAL.

6.1.2.4 Set the Function Select knob to the "RESISTANCE" area with the "GROUND WIRE" selection made.

6.1.2.5 With the VA3000 in the STANDBY mode, plug the VA3000 into the test receptacle of the safety analyzer. The reading then shown on the analyzer is the "Chassis Resistance". Bend and exercise the power cord to check for intermittent readings. Record the reading on the PMS form. ≤ 0.1 ohm

6.1.3 Chassis Leakage Test

6.1.3.1 Set the GROUND, NEUTRAL and POLARITY switches of the analyzer to the NORMAL position.

6.1.3.2 Set the Function Select knob to the "LEAKAGE CURRENT" area with the CHASSIS selection made.

6.1.3.3 Turn the VA3000 ON and allow the self test to complete.

6.1.3.4 Record the total leakage current with the polarity and ground switches set to the following positions:

NOTE: Set the VA3000 to STANDBY before changing the polarity switch on the safety analyzer, then turn the VA3000 ON.

Ground	Polarity	Ground	Polarity
Normal	Normal	Open	Reversed
Open	Normal	Normal	Reversed

Verify that the leakage current is 50 microamps or less in each of the positions.

NOTE: Ensure that the VA3000 has been plugged into a live AC receptacle at least 10 minutes before proceeding with the PMS.

6.2 Service Screen

6.2.1 Plug the VA3000 into a grounded 120 VAC outlet. Press the "ON" key.

6.2.2 Record the software version number shown in the upper right hand corner of the display.

6.2.3 Verify that all the diagnostics are labeled PASS and that the unit is FUNCTIONAL.

6.2.4 Simultaneously press and hold the MONITOR and SYSTEM CONFIG keys; while holding the keys, press the rotary dial to enter the Main Service Screen.

6.2.5 Record the LAST SERVICE DATE on the PMS form.

6.2.6 Record the HOURS RUN SINCE LAST SERVICE on the PMS form.

6.2.7 Record the TOTAL HOURS RUN on the PMS form.

6.2.8 Record the OXIM SW Version on the PMS form.

6.2.9 Record the GAI SW Version on the PMS form.

6.2.10 Record the GAS BENCH SW Version on the PMS form.

6.2.11 Enter the I.D. number and a service code on the Main Service Screen.

6.2.12 Press the MONITOR key.

6.3 SpO_2/Pulse

6.3.1 Plug the SpO_2 sensor pre-amp cable into the interface panel, and connect a Nellcor® Model 2500 pocket simulator to the pre-amp.

(While in the Main Service Screen, note the "OXIM SW VERSION" number. It should be of the form "V x.x.x" or "Vx.x.x.x". The former indicates that a Nellcor MP-202 is installed. The latter indicates a MP-203.)

6.3.2 The monitor should display a value between 80 and 82 for oxygen saturation, and a value between 60 and 62 for pulse rate (39 and 41 if the monitor's pulse oximeter module is a Nellcor MP-203).

6.3.3 Disconnect the pocket simulator and connect the finger sensor.

6.3.4 Attach the sensor to the operator's finger, and observe the pulse and oxygen saturation readings. Verify that the readings are stable for both SpO_2 and pulse.

6.3.5 Remove the sensor from the finger.

6.3.6 After ten seconds, the Warning message NO OXI PULSE should appear on the central alarm display.

6.3.7 Re-attach the sensor to the finger.

6.3.8 Press the ALARM LIMITS key. Ensure that the alarms are set to ON.

6.3.9 Raise the low pulse alarm limit to above the actual rate. (Note: you may need to adjust the high pulse alarm limit to allow the low pulse to break the threshold.) The Warning message OXI PULSE LOW should appear on the central alarm display.

6.3.10 Set the low pulse alarm limit to 60.

6.3.11 Decrease the high pulse alarm limit below the actual pulse rate.

6.3.12 The Caution message OXI PULSE HIGH should appear on the central alarm display.

6.3.13 Set the high pulse alarm limit to 100.

6.3.14 Raise the low SpO_2 alarm limit above the actual rate.

6.3.15 The Warning message SPO2 LOW should appear on the central alarm display.

6.3.16 Set the low SpO_2 alarm limit to 90.

6.3.17 Decrease the high SpO_2 alarm limit below the actual SpO_2 value.

6.3.18 The Caution message SPO2 HIGH should appear on the central alarm display. Set the SpO_2 high alarm limit to 100.

6.3.19 Enter the Alarm Limits Screen and set the SpO_2 alarms to OFF.

6.4 NIBP

6.4.1 Disconnect the NIBP patient cuff from the hose assembly.

6.4.2 Press the [NIBP START] key.

6.4.3 When the NIBP pump stops, verify that the Advisory message BP CUFF LEAK appears on the central alarm display.

6.4.4 Re-enter the Main Service Screen as follows: Simultaneously press and hold the [MONITOR] and [SYSTEM CONFIG] keys; while holding the keys, press the rotary dial to enter the Main Service Screen.

6.4.5 Scroll to and select the box labeled MONITORS.

6.4.6 Scroll to and select the box labeled NIBP.

6.4.7 Connect a BP cuff and hose assembly to the interface panel.

6.4.8 Wrap the cuff loosely around a cylindrical object.

6.4.9 Use the rotary dial to position the cursor at TEST.

6.4.10 Press the dial to begin cuff inflation.

6.4.11 Observe the Cuff Pressure Value. Allow 60 seconds for the reading to stabilize; note the pressure value. The pressure shall drop no more than 5 mm Hg from this value in the next three minutes.

NOTE: With software version 1.05 the sensitivity of the automatic test may be too high. If a "FAIL" message appears on the Status line, it should be disregarded if the above pressure test does not indicate a leak.

NOTE: If this test indicates a leak, replace the cuff extension hose and cuff, and repeat the test.

6.4.12 Press the [ALARM LIMITS] key to return to the Alarm Limits Screen.

6.4.13 Apply the patient cuff and press the [NIBP START] key to obtain a reading.

6.4.14 Lower the systolic high alarm limit below the actual systolic value.

6.4.15 The Caution message NIBP SYSTOLIC HI should appear on the central alarm display.

6.4.16 Set the systolic high alarm to 150.

6.4.17 Raise the systolic low alarm limit above the actual systolic value. (Note: you may need to adjust the systolic high alarm limit to allow systolic low value to break the threshold.)

6.4.18 The Caution message NIBP SYSTOLIC LO should appear on the central alarm display.

6.4.19 Press the NIBP STAT key.

6.4.20 Measure the time from the end of the first Stat inflation to the start of the next Stat inflation. The elapsed time should be between 2 and 4 seconds.

6.4.21 Press the NIBP STOP key.

6.5 CO_2/Sample Line

NOTE: Ensure that the disposable reservoir and sample line are attached and are clear of any fluid or obstructions. Replace them if necessary.

6.5.1 Press the MONITOR SETUP key.

6.5.2 Use the rotary dial to position the cursor at SAMP FLOW on the display.

6.5.3 Press the dial to highlight the flow rate bar graph.

6.5.4 Connect a test flow meter to the exhaust port on the rear panel of the VA3000.

6.5.5 Rotate the dial until the flow rate is at its lowest setting (bar graph completely empty). The flow meter should read 100 ml/min. ±25.

6.5.6 Rotate the dial until the flow rate is at its highest setting (bar graph completely filled). The flow meter should read 200 ml/min. ±25.

NOTE: If either of the previous two steps do not meet specification, perform the Gas Sample Line Flow Calibration outlined in Section 5.

6.5.7 Press the MONITOR key on the main key panel.

6.5.8 Occlude the sample line. A Line Block advisory message should appear within 15 seconds. If the advisory does not appear, perform a Span calibration procedure or contact the NAD Service Department.

6.5.9 Release the sample line occlusion. The Line Block Advisory should disappear within 5 seconds.

NOTE: Before performing an Accuracy Test or Span Cal, ensure that the CO2 UNITS is set to %, and that the VA3000 is in full accuracy mode (warmup complete).

6.5.10 Perform the following accuracy test:

6.5.11 Press the [MONITOR SETUP] key on the main key panel.

6.5.12 Use the rotary dial to position the cursor at CO2/AGT. A box appears around the CAL selection.

6.5.13 Press the dial to highlight the box and begin a zero calibration. When the zero calibration is complete, the box is no longer highlighted.

6.5.14 When the zero calibration is complete. press the [MONITOR] key to return to the Monitor Screen.

6.5.15 Attach the CO_2 cylinder adapter (NAD P/N 4110216) to the CO_2 verification gas cylinder (NAD P/N 4107979).

6.5.16 Slightly open the flow control valve on the CO_2 cylinder adapter by turning it counter-clockwise.

6.5.17 Wait for one full screen waveform sweep, then close the cylinder valve and remove the sample line from the adapter.

6.5.18 Verify that the CO_2 display indicates a value between 4.8% and 5.2%. If the reading is not within the specified range, perform a Span calibration procedure.

6.5.19 Press the [ALARM LIMITS] key.

6.5.20 Set the CO_2 alarms to ON.

6.5.21 Breath into the sample line to obtain a CO_2 reading.

6.5.22 Raise the CO_2 low alarm limit above the actual CO_2 value.

6.5.23 The Caution message ET CO2 LOW should appear on the central alarm display.

6.5.24 Set the CO_2 low alarm limit to 1.3%.

6.5.25 Lower the CO_2 high alarm limit below the actual CO_2 value.

6.5.26 The Caution message ET CO2 HIGH should appear on the central alarm display.

6.5.27 Set the CO_2 high alarm limit to 6.6%.

6.5.28 Breathe into the sample line. Begin timing when a new CO_2 measurement appears on the screen.

6.5.29 The Caution message APNEA-CO2 should appear on the central alarm display within 15 seconds.

6.5.30 The APNEA-CO2 message should be upgraded to a Warning on the central alarm display within the next 15-second period (30 seconds total).

6.5.31 Breathe short, repetitive breaths into the sample line in order to generate an inspired CO_2 >0.7%.

6.5.32 Verify that the Advisory message INSP CO2 HIGH appears on the central alarm display when the inspired CO_2 reading exceeds 0.7%. (Note: other advisories may need to be cleared to create space for this advisory.)

6.5.33 Enter the Alarm Limits Screen and set the alarms to OFF.

6.5.34 Press the MONITOR key.

6.6 Alarm Circuit Delay Test

6.6.1 Create any "Warning Alarm" condition.

6.6.2 Press the key.

6.6.3 Verify that the audio portion of the alarm is silenced.

6.6.4 Verify that a "60" appears at the bottom of the Advisory alarm column. (The alarm silence is 120 sec. for software version 1.05 and later.)

6.6.5 Press the key twice.

6.6.6 Verify that a "120" appears at the bottom of the Advisory alarm column.

6.7 System Configuration

6.7.1 Press the SYSTEM CONFIG key.

6.7.2 Verify the correct Time and Date.

6.7.3 Note the "System Settings" current selections, verify that the selections can be changed, and return the selections to their original settings.

NOTE: "POP-UP ALARMS" are non-selectable unless the VA3000 is interfaced to an anesthesia machine.

6.7.4 Scroll to and select the box labeled "AUTO LOG".

6.7.5 Note the current settings, verify that the selections can be changed, and return the selections to their original settings.

6.7.6 Scroll to and select the box labeled "SERIAL PORTS".

6.7.7 Verify that the parameters are set to enable communications between the VA3000 Series monitor and any interfaced unit, if applicable.

6.7.8 Scroll to and select the box labeled "DATASCAN". This box is labeled "AUTOSET CONTROL" on monitors with version 1.06 and later software.

6.7.9 Note the current settings, verify that the selections can be changed, and return the selections to their original settings.

6.7.10 Press the MONITOR key.

6.8 Reset/PMS Criteria

6.8.1 Re-enter the Main Service Screen as follows: Simultaneously press and hold the MONITOR and SYSTEM CONFIG keys; while holding the keys, press the rotary dial to enter the Main Service Screen.

6.8.2 Scroll to and select the box labeled RESET HOURS to reset the hours since last service to zero.

6.8.3 Scroll to and select the box labeled PMS SCHEDULE.

6.8.4 Enter the next PMS due date.

6.8.5 Press the ON/STBY key to power down the monitor.

6.9 Accessory Attachments

Attach each accessory item to its intended location. Repair or replace any item that cannot be properly attached.

6.10 Visual Inspection

Inspect all surfaces of the instrument. Replace labels, disposable items and damaged parts as necessary.

6.11 Operator Manual

Verify the availability/location of the VITALERT 3000 Series Operator's Manual.

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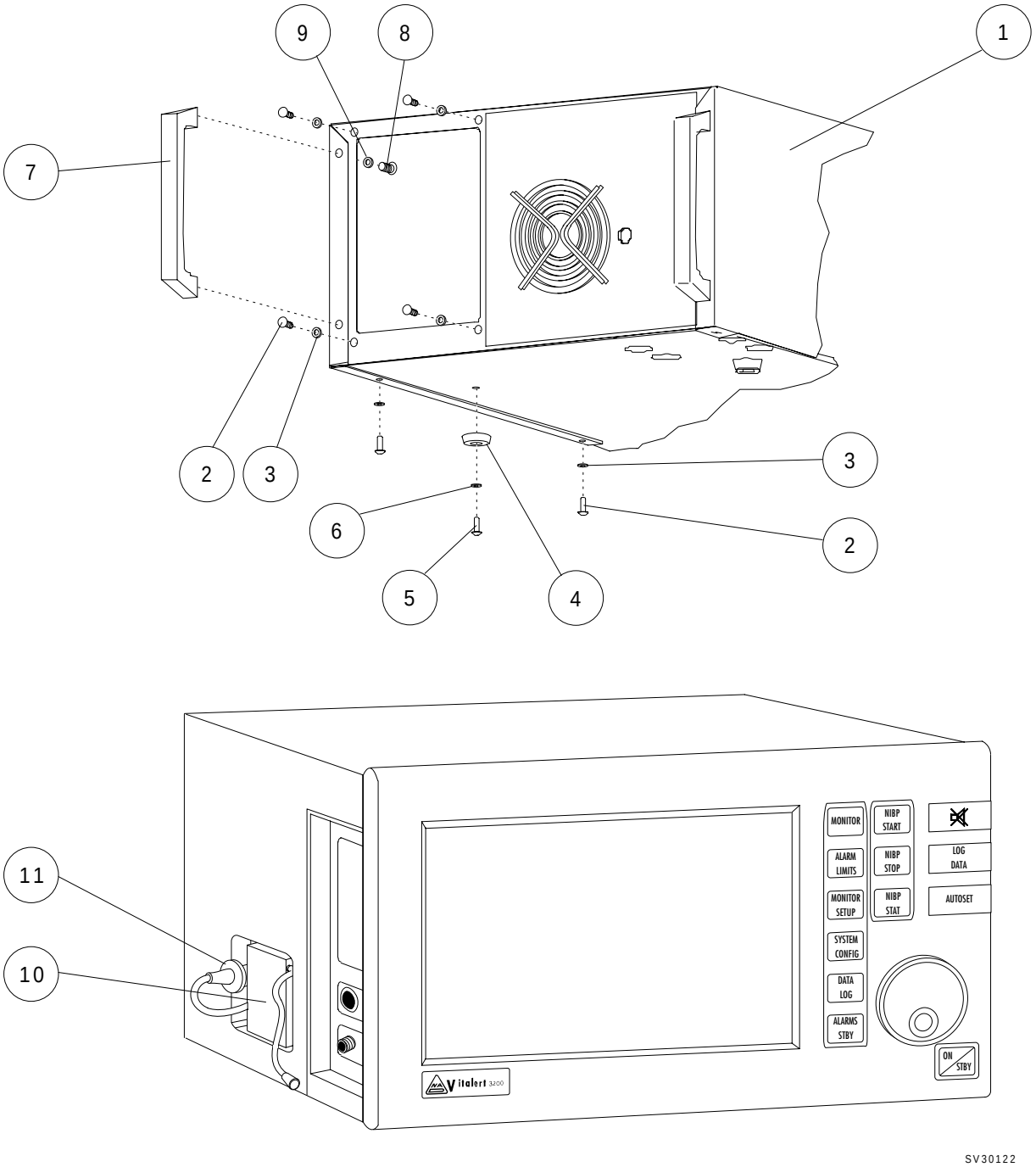
7.0 SPARE AND REPLACEMENT PARTS

Part numbers for field-replaceable items on the VITALERT 3000 Series monitoring system are listed on the following pages, along with part numbers for related hardware and cables.

The item numbers are keyed to the accompanying illustrations to aid in identifying the item and its location.

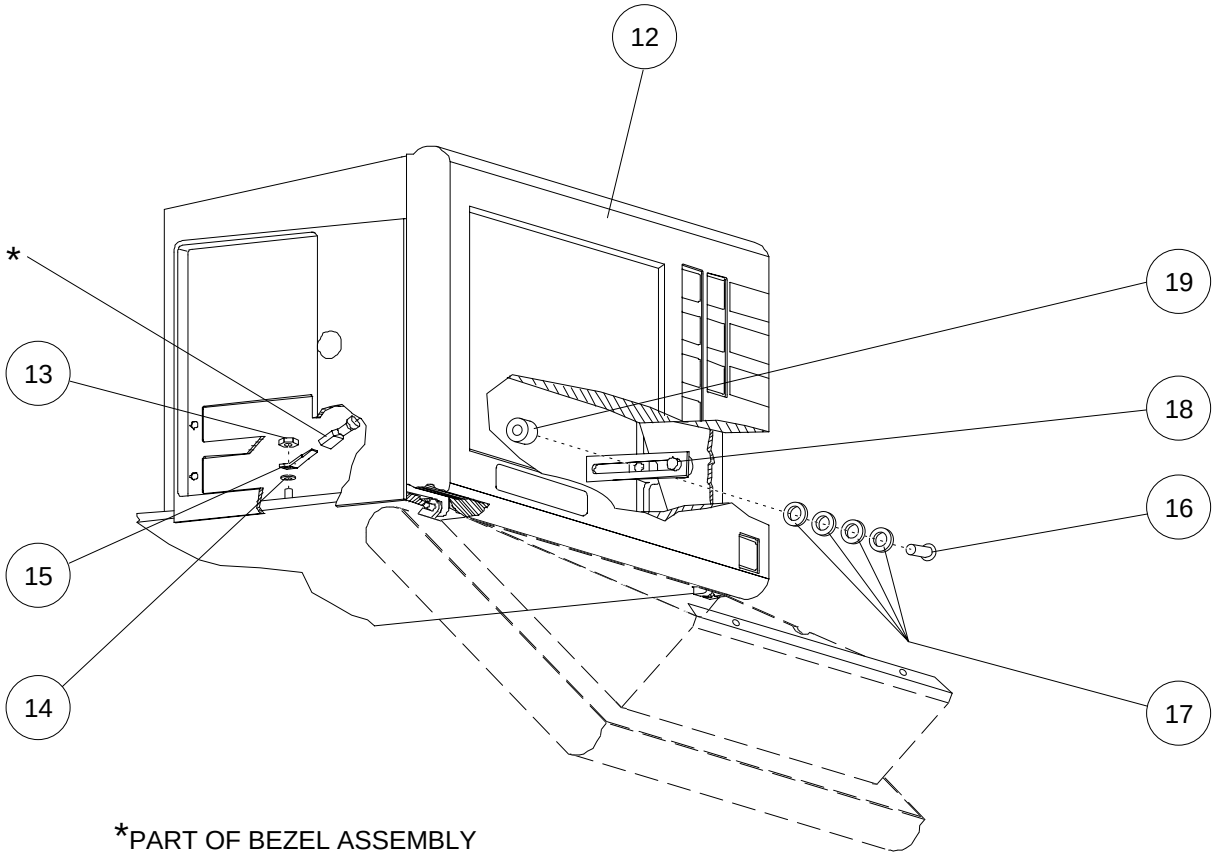
ASSEMBLY/PART PAGE

SPARE AND REPLACEMENT PARTS (continued) **VA3000**



ITEM	DESCRIPTION	PART NUMBER
1	Cover, NAD color	4112014
	Euro color	4112014-001
2	Screw, 6-32 x ⅜ in. Btn Hd Skt (8x)	HW09000
3	Lock Washer, #6 Ext-t (8x)	HW68006
4	Foot (Bumper) (4x)	4110160
5	Screw, 6-32 x 7/16 in. Btn Hd Skt (4x)	HW09017
6	Lock Washer, #6 Int-t (4x)	HW67007
7	Handle (2x), NAD color	2208115
	Euro color	2208115-001
8	Screw, 10-32 x ⅜ in. Btn Hd Skt (4x)	HW09005
9	Lock Washer, #10 Int-t (4x)	HW67006
10	Water Trap	4110616
11	Air Filter	4111751

SPARE AND REPLACEMENT PARTS (continued) **VA3000**

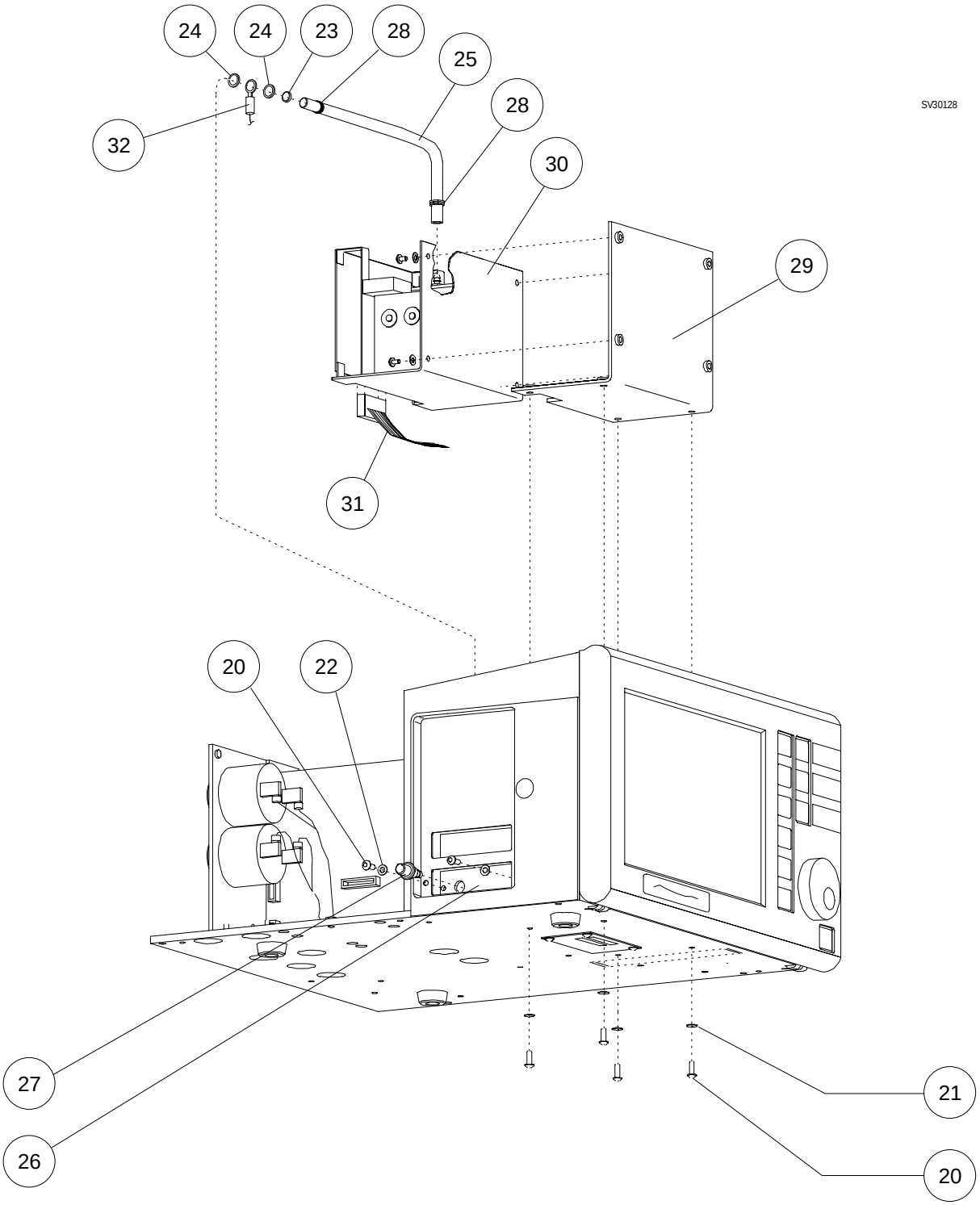


*PART OF BEZEL ASSEMBLY

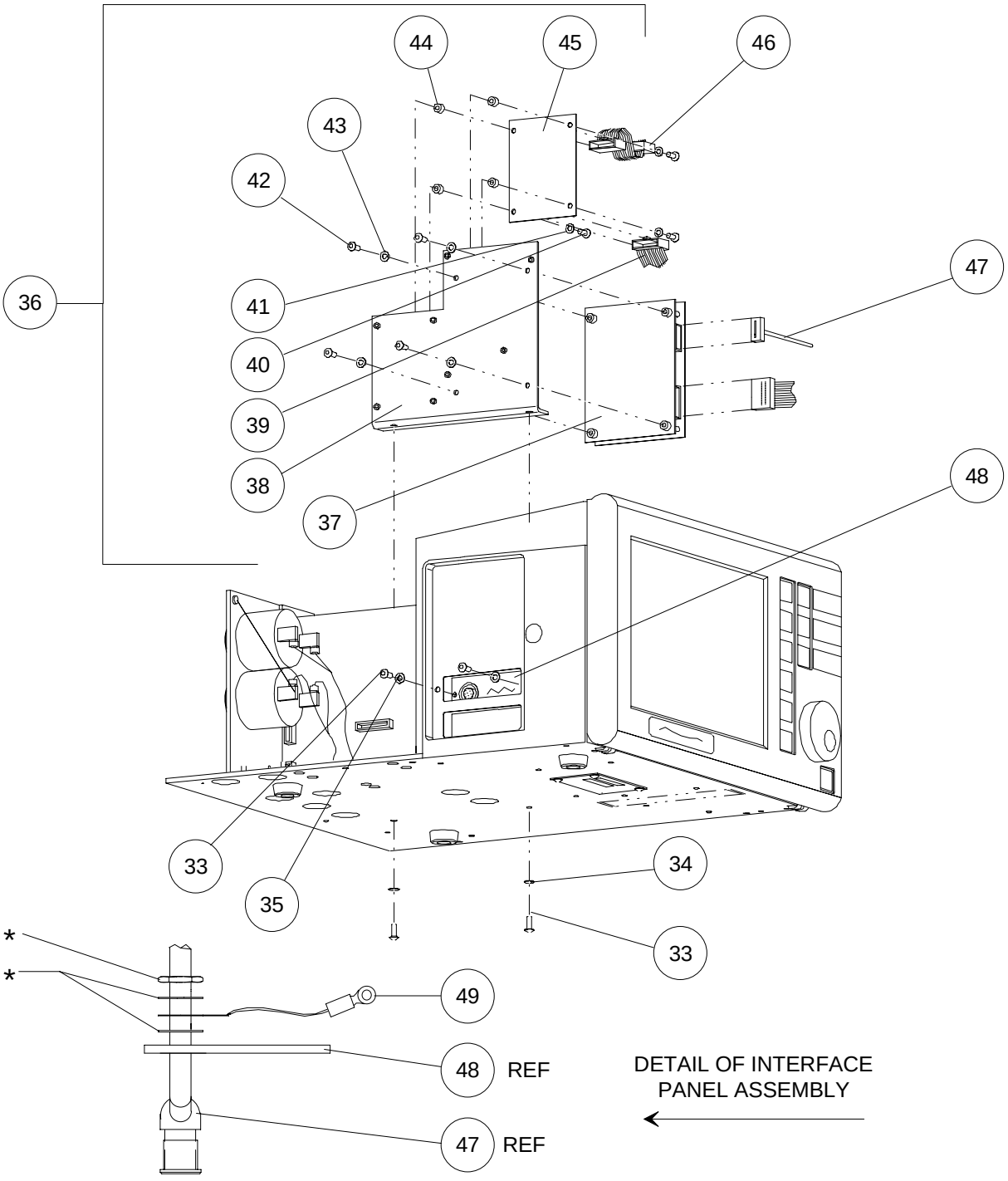
SV30124

ITEM	DESCRIPTION	PART NUMBER
12	Front Bezel Assembly (Incl. Display Panel, Rotary Encoder, Switch Panel)	
	NAD color	4112019
	Euro color	4112019-001
13	Nut, Kep, 6-32	HW55003
14	Lock Washer, #6, ext-t	HW68000
15	Adapter terminal	4107068
16	Screw, 10-32 x 1¼ in.Locking (2x)	4111709
17	Spring Washer (4x each side)	4111710
18	Hinge Stop (Connecting Link) (2x)	4111640
19	Friction Disk (2x)	4111668

SPARE AND REPLACEMENT PARTS (continued) **VA3000**



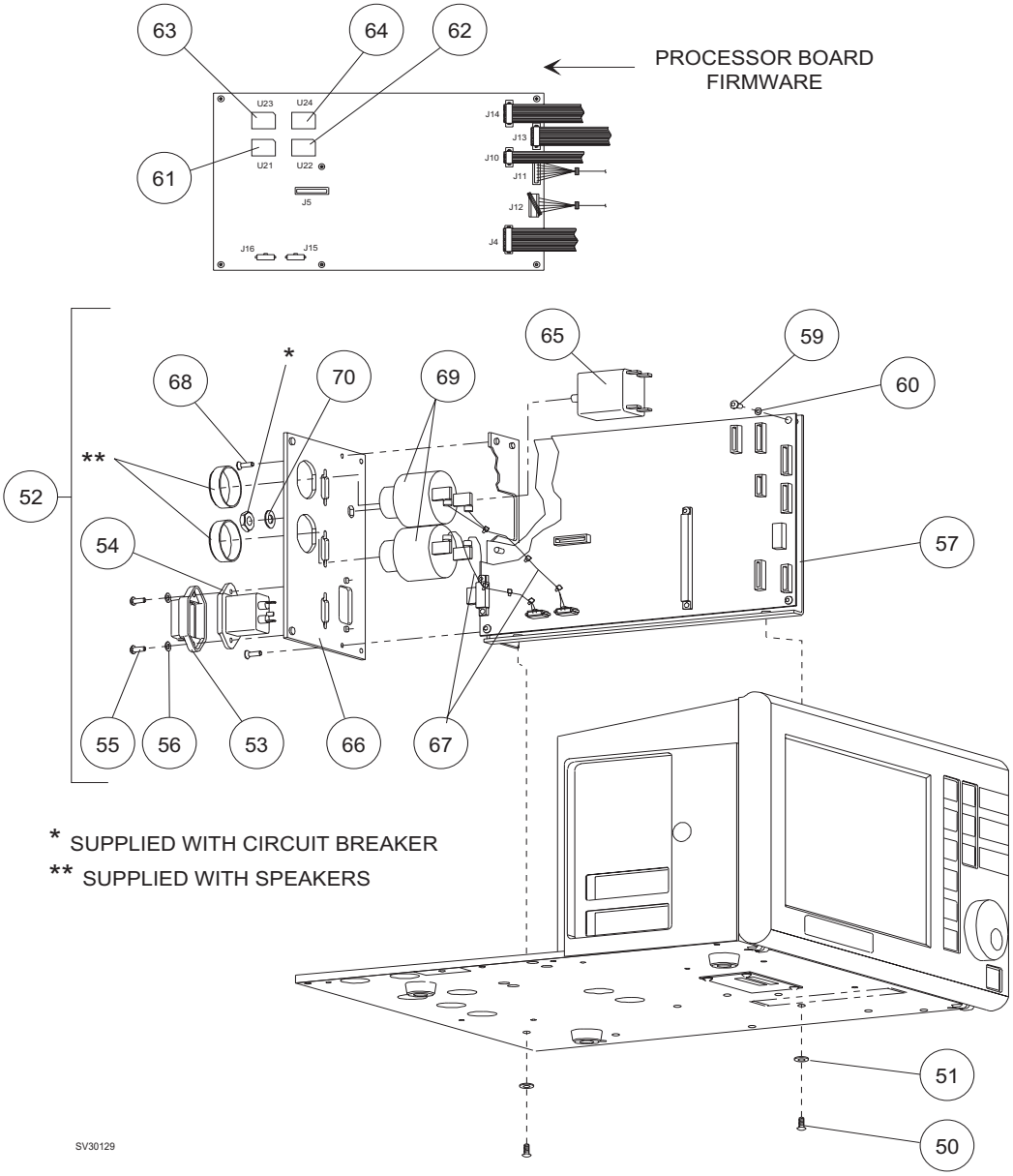
ITEM	DESCRIPTION	PART NUMBER
20	Screw, 6-32 x ⅜ in. Btn Hd Skt (10x)	HW09000
21	Lock Washer, #6 int-t (8x)	HW67007
22	Lock Washer, #6 int-t (2x)	HW67015
23	Jam Nut	HW52005
24	Lock Washer, 5/16 int-t (2x)	HW67010
25	Hose, 3/16 I.D., 9 in.	ML08014
26	Sphygmomed Interface Panel, NAD color	4107941
	Euro color	4107941-001
27	Feedthru Connector, 5/16-32 x 3/16 I.D. Hose	4108257
28	Hose Clamp (2x)	4110618-006
29	Bracket, NIBP	4111643
30	BP Module	4109794
31	Cable, NIBP to Processor	4111700
32	Ground Wire Assembly	4108822



* SUPPLIED WITH NELLCOR CABLE ASSEMBLY

ITEM	DESCRIPTION	PART NUMBER
33	Screw, 6-32 x ⅜ in. Btn Hd Skt (4x)	HW09000
34	Lock Washer, #6 int-t (2x)	HW67007
35	Lock Washer, #6 int-t (2x)	HW67015
36	SpO_2 Assembly	SE10027
37	Pulse Oximeter Module (Nellcor® MP-202)	4111097
	Pulse Oximeter Module (Nellcor® MP-203)	4112575-001
38	Bracket, Pulse Oximeter	4111636
39	Cable, Pulse Oximeter Module to Isolation Module	4110237
40	Screw, 4-40 x ½ in. Btn Hd Skt (4x)	HW09028
41	Lock Washer, #4 int-t (4x)	HW67011
42	Screw, 6-32 x ⅜ in. Btn Hd Skt (4x)	HW09000
43	Lock Washer, #6 int-t (4x)	HW67007
44	Spacer (4x)	4110792-017
45	Isolation Module	4111654
46	Cable, Isolation Module to Processor Board	4111701
47	Nellcor® Cable Assembly (Incl. Nut & Lock Washers)	4111731
48	Pulse Oximeter Interface Panel, NAD color	4108644
	Euro color	4108644-001
49	Ground Wire Assembly	4111761

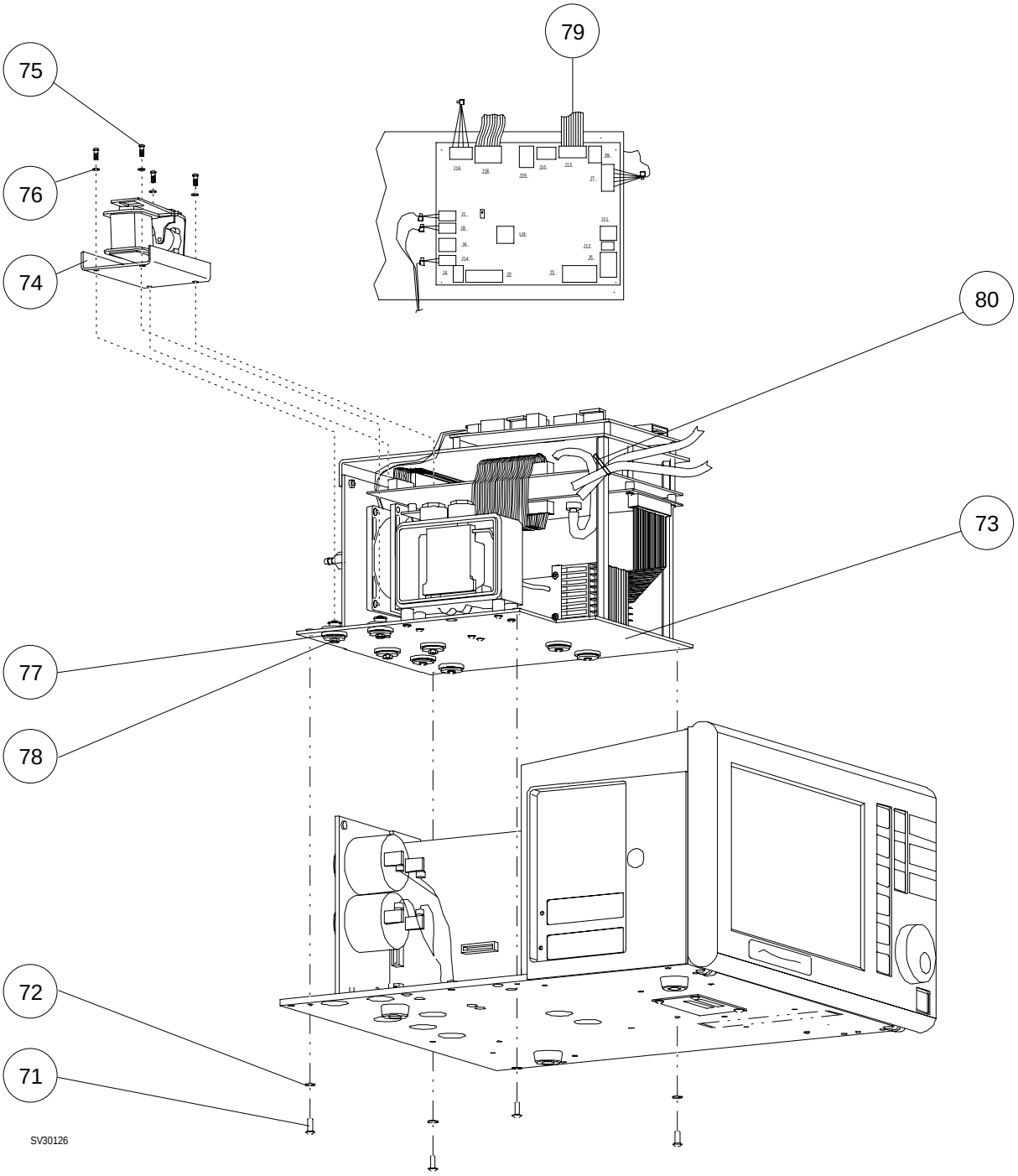
SPARE AND REPLACEMENT PARTS (continued) VA3000



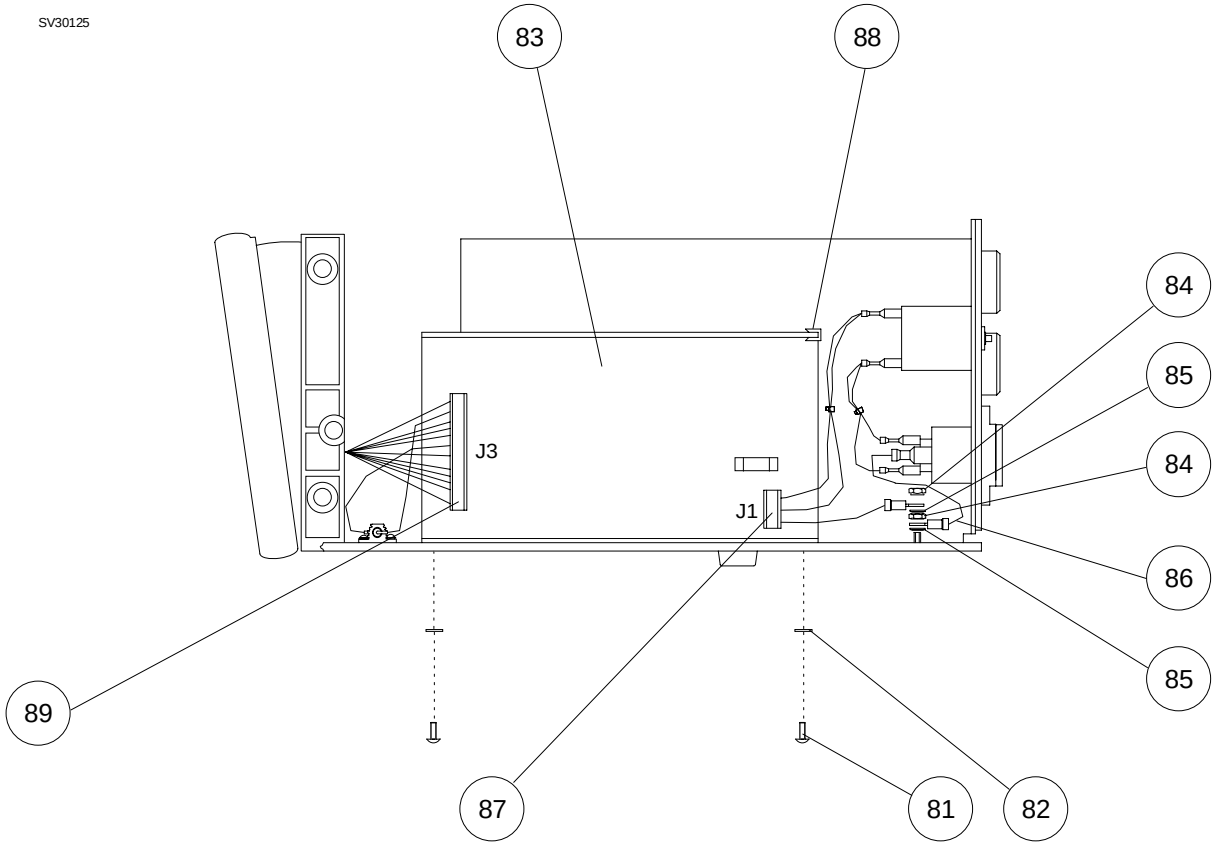
* SUPPLIED WITH CIRCUIT BREAKER
** SUPPLIED WITH SPEAKERS

ITEM	DESCRIPTION	PART NUMBER
50	Screw, 6-32 x ⅜ in. Btn Hd Skt (2x)	HW09000
51	Lock Washer, #6 int-t (2x)	HW67007
52	Processor Assembly, NAD color	SE10028
	Euro color	SE10028-001
53	Mount, Outside Adapter	4109577
54	Mains Filter	4109578
55	Screw, 4-40 x ⅜ in. Btn Hd Skt (2x)	HW09052
56	Lock Washer, #4 int-t (2x)	HW67011
57	Bracket, Processor	4111665
58	Deleted	
59	Screw, 6-32 x ⅜ in. Btn Hd Skt (4x)	HW09000
60	Lock Washer, #6 int-t (4x)	HW67007
61	Firmware, U21, HI/HI	4111711-001
62	Firmware, U22, MD/HI	4111711-003
63	Firmware, U23, MD/LW	4111711-004
64	Firmware, U24, LW/LW	4111711-002
65	Circuit Breaker, 2P, 3.5A	4110537-006
66	Plate, I/O (Rear Panel)	4111642
67	Speaker Wire Harness (2x)	4111669
68	Screw, 6-32 x ¼ in. Locking (2x)	4111785
69	Speaker (2x)	4106335
70	Lock Washer, ⅜ int-t	HW67004

SPARE AND REPLACEMENT PARTS (continued) VA3000



ITEM	DESCRIPTION	PART NUMBER
71	Screw, 6-32 x ⅜ in. Btn Hd Skt (4x)	HW09000
72	Lock Washer, #6 int-t (4x)	HW67007
73	Gas Analyzer Assembly, NAD color	4112021
	Euro color	4112021-001
74	Pump	4111764
75	Screw, 6-32 x ¾ in. Btn Hd Skt (4x)	HW09009
76	Lock Washer, #6 int-t (4x)	HW67007
77	Spacer (Flat Washer) (4x)	4110792-050
78	Nut, Kep, 6-32 (4x)	HW55003
	Water Trap Housing w/adj. flow restrictor (replaces earlier version)	
	NAD color	S010230
	Euro color	S010230-001
	PVC Sample Line	4112264
	Later design w/Luer fitting gender change to prevent connection to water trap housing without air filter	4113334
	Water Trap Reservoir	4110616
	Air Filter	4111751
79	Cable, Gas Analyzer to Processor	4111735
80	Tie Strap, 0.09W x 4⅛ in.	4106068


SV30125
83
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J3
J1

ITEM	DESCRIPTION	PART NUMBER
81	Screw, 6-32 x ⅜ in. Btn Hd Skt (2x)	HW09000
82	Lock Washer, #6 int-t (2x)	HW67007
83	Power Supply	4111664
84	Nut, Kep, 6-32 (3x)	HW55003
85	Lock Washer, #6 ext-t (3x)	HW68000
86	Ground Wire Assembly	4111321
87	Wire Harness, Power Supply to Filter	4111744
88	Grommet Strip, 1.75 in.	4109442
89	Wire Harness, Power Supply to Processor & Gas Analyzer	4111704

Additional Items Not Shown:

Pulse Oximeter Interface Cable W/Pre-amp	4108982
Durasensor, Finger	4108983
Superseded by (Supplier: Epic)	4113823
BP Cuff, Adult	4109095
Power Cord Assembly	4110334
Tube, PVC Sample Line	4108103
Adapter, Airway W/Fitting	4108104
Cable Assembly, DB9 - DB9, 2½ ft.	4110328

Touch-up paint: Euro white	7900380
Touch-up paint: Euro blue	7901261

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Vitalert 3000 Service Manual

Rev. N summary of changes

Cover ..... Changed Rev. and Date
5-10 ..... Removed reference to calibration kit in para. 5.4.12

Rev. M summary of changes

Cover ..... Changed Logo, Rev. and Date
7-10 ..... Removed item number 58 from illustration
7-11 ..... Removed all reference to item number 58 from lister page

Rev. L summary of changes

Page	Description
ii	Added Euro white & Euro blue touch-up paint to TOC
7-1	Added Euro white & Euro blue touch-up paint to TOC
7-15	Added P/Ns for Euro white & Euro blue touch-up paint